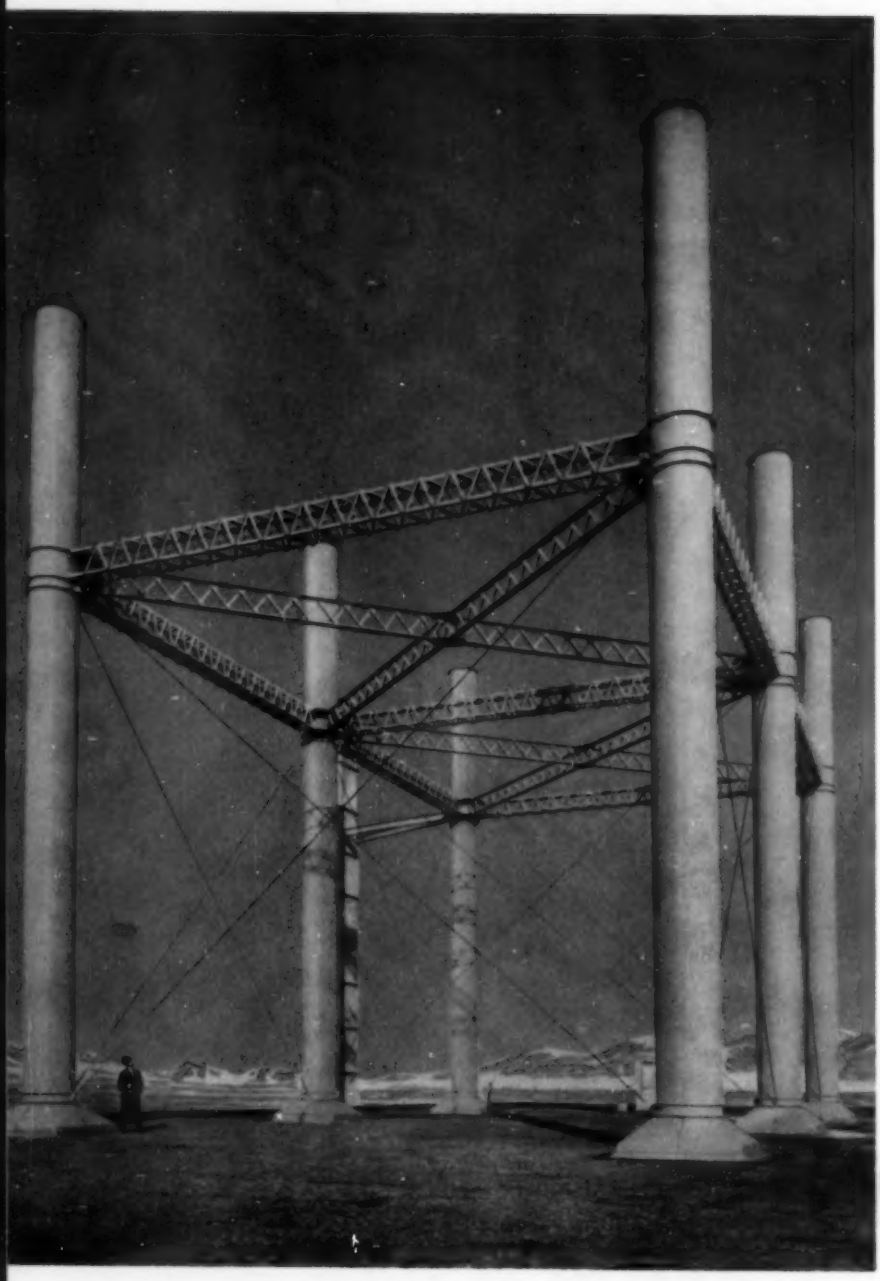
Industry and Power



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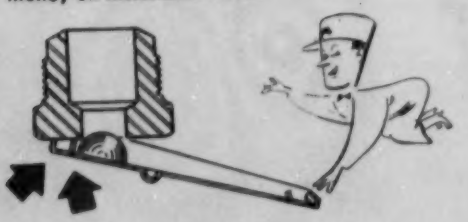
for engineers and executives responsible for

— engineered plant facilities

How Armstrong Traps Save you Money

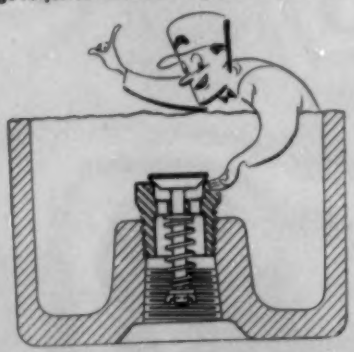
Choice of body styles saves money on installation costs.

Hardened, ground and lapped valve and seat; stainless steel mechanism resists wear and corrosion—saves money on maintenance.



Two phase leverage means higher capacity in a smaller trap. Armstrong traps have optimum relation between leverage, valve travel, bucket weight, capacity and overall size.

This internal check valve saves labor and fittings required to install regular check valve.



This trap with built-in strainer costs less than separate trap and strainer—requires less labor and fittings to install.

Get the full facts on money-saving Armstrong traps. Send for free Catalog J. Clip and mail coupon today.

ARMSTRONG MACHINE WORKS
820 Maple Street, Three Rivers, Michigan

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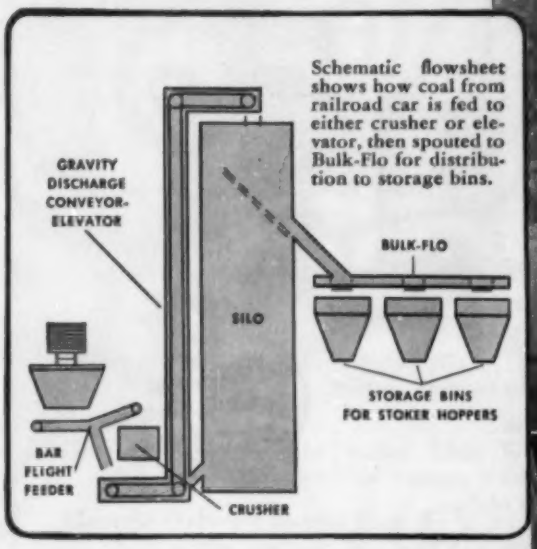
ARMSTRONG STEAM TRAPS

Circle 500 on Reply Card for more data

FROM SIDING TO STOKER--

it's Link-Belt for low-cost coal handling

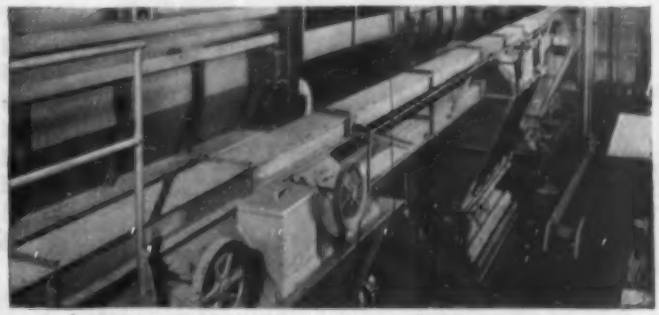
Up to 50 tons of coal per hour can be unloaded from railroad cars at this industrial power plant. Link-Belt gravity discharge conveyor-elevator is 70 ft. high.



Schematic flowsheet shows how coal from railroad car is fed to either crusher or elevator, then spouted to Bulk-Flo for distribution to storage bins.

Simple and effective, this Link-Belt bar flight feeder travels at 45 ft. per min., operates on 45-ft. centers.

WHETHER your coal handling requirements are large or small—Link-Belt can give you a system that assures top efficiency. A complete line of quality equipment is backed by unequalled engineering experience. And Link-Belt will carry through the entire job from planning to erection, if desired. See your Link-Belt representative for all the facts, or write for Book 2410 that shows the latest in modern power plant layouts.



Dust-tight Link-Belt Bulk-Flo feeder-conveyor delivers coal to any of three stoker storage bins at 15 tons per hour.

LINK-BELT

COAL HANDLING EQUIPMENT

13.408

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

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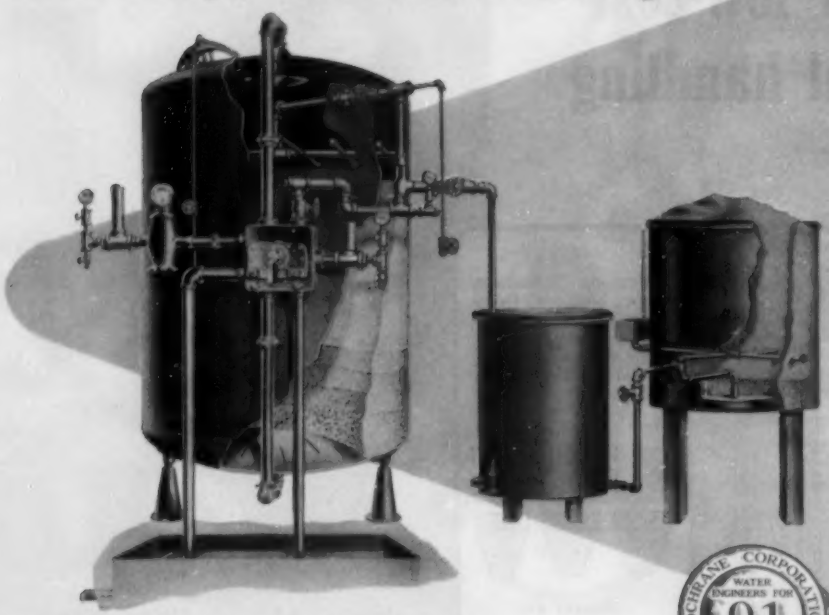
HIGH EFFICIENCY

Cochrane ZEOLITE SOFTENERS

provide easy, economical operation



The Cochrane Hydromatic Single Control Valve provides positive, accurate control of all phases of the softening and regenerating cycle.

It is so simple to operate that no technical knowledge of the softening process or the equipment is required. High quality effluent is thus assured at a minimum cost and maximum delivery.

Cochrane's 91 years of water conditioning leadership and its complete line of equipment assures you unbiased recommendations for equipment to performance requirements. For the right answer to your water problem, call a Cochrane Engineer today.

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Please send me a copy of your Publication 4520-A on your Zeolite Softeners with the Cochrane Hydromatic Single Control Valve.

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Hot Process Softeners · Deaerators · Deathalizers · Demineralizers · Reactors · Continuous Blow-Off · Specialties · C-B Systems

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Industry and Power

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Ratchet Head Model—Two Tools in One.

Head only of Plain Head Model.

When ordinary wrenches were used at International Harvester Company, Louisville Works, for holding a tractor transmission cover casting during a milling operation, warpage due to excessive pressure and clamping was charged with 25 to 30 rejects daily. At this stage, each casting costs about $9.45. With the use of PROTO Torquers, rejects due to clamping were eliminated entirely. IH foremen like the PROTO Torquer because it overcomes the problems of dial types, is easy to operate, speeds work and withstands rough usage... Other leading manufacturers, after exhaustive tests, are using the torquer and effecting huge savings. Ask your PROTO dealer for a demonstration of this revolutionary *money-earning* tool. Send 10¢ for 68-page catalog to

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acorns

. . . recently announced . . . worth watching

Aluminum Pressure Vessels

Manufacturers and users of unfired pressure vessels are offered a valuable new construction material with the recent approval of aluminum alloy GR40A (commercial designation A54S) by the Boiler Code Committee of the A.S.M.E.

Alcoa alloy A54S offers higher mechanical properties than any of the alloys previously approved for welded pressure vessels. For this reason, allowable design stresses are higher. Operating at elevated temperatures, the alloy becomes more desirable because it maintains its strength better.

While A54S is more expensive than 3S and 4S alloys on an equal weight basis, it is more economical on the basis of equivalent strength. These economies are expected to result in the increased use off aluminum for pressure vessels.

Stone Saw

A new and faster method of cutting glass melamine, made possible through special adaptation of a Stone Saw, has been introduced at the Boston Naval Shipyard. Besides cutting glass melamine up to two inches thick at the rate of four feet per minute, this versatile tool is reported to be easily adaptable for cutting granite, marble, tile, brick, structural glass, plastic, refractories, and asbestos products. By attaching abrasive cutting wheels to the machine, many types of metal, wet or dry, can be cut with greater speed and accuracy than by conventional methods.

Plastic Pipe

A new method for economically molding reinforced plastic pipe, and molding it on the spot where it is to be installed, has been designed by the Bassons Industries Corp. Made of glass fibers and polyester resins, this material is notable for its lightweight, great strength, and resistance to corrosion.

About Noise Control

How to locate noise, find its cause, and cushion vibrations and jars in industrial equipment is discussed in the recent U. S. Air Force "Handbook of Acoustic Noise Control". The study has a great deal to say about the bio-acoustical aspects of the various control problems, the noise-reducing characteristics of structures, and the effectiveness of commercial vibration-reducing and -absorbing materials.

Titanium Casting Experiments

The problem of successfully casting commercial alloys of titanium appears to be moving toward solution. Up until now, the high rate of reaction between molten titanium and investment materials had frustrated casting attempts by contaminating the alloy with undesirable elements. The Mercast Corp. working with Alloy Precision Castings Co. recently poured in the laboratory an aircraft latch using a modified Mercast ceramic mold. Experiments are continuing and results are said to be "encouraging".

Humidity Control

Preventing the curling of paper and poor inking in printing plants can be effected by better control of neutralizers and physical or chemical dehumidifiers. Typical engineering and installation jobs are given as examples and an extensive bibliography is included in a 12 page report by the National Research Council in Canada.

Metal Sheet Filters

A porous metal sheet has been developed by sintering pure nickel powder, or the powder of pre-alloyed Monel or 18-8 stainless steel. It is strong and its chemical and physical characteristics parallel those of solid metals. Filter users have already investigated its properties and found it can be used for applications where previously there was no satisfactory material to do the job.

Advantages claimed are that it can be shaped similarly to solid sheet, welded, sheared, and fabricated; is chemically resistant to most corrosives, but not susceptible to breakage; retains its strength and ductility at high and low temperatures; has a high flow rate and pressure drop; can be operated at higher pressures with greater retentivity of solids; will filter 2/10 to ½ micron particles in gas; is easily cleaned by back pressure, mechanical, or chemical means.

DARLING VALVES

INSIDE STORY...

on trouble-free valve performance

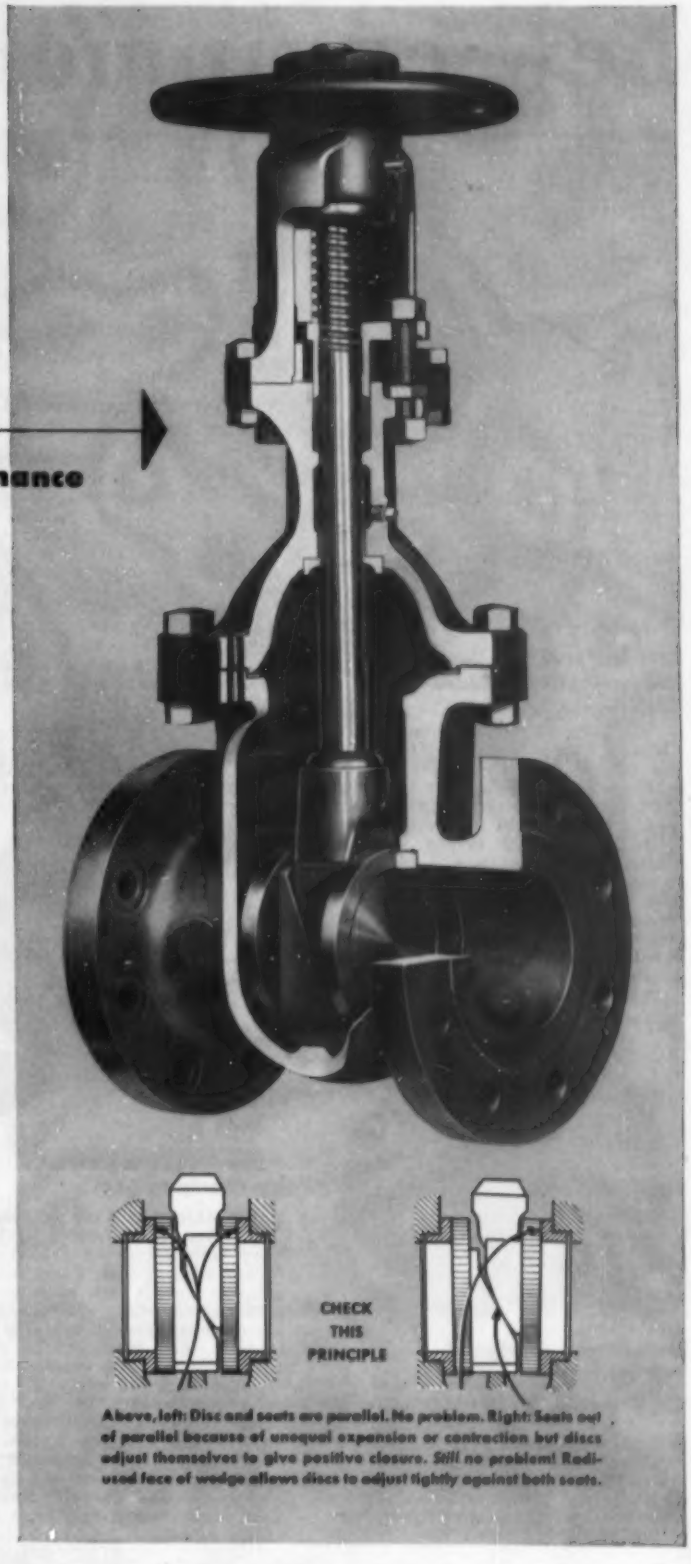
Install DARLING Revolving Disc GATE VALVES

Just what the doctor ordered . . . that's what users say about Darling fully revolving double disc, parallel seat gate valves. *Reason:* These unique valves adjust automatically to compensate for valve body distortion.

Moreover, Darling gate discs, independently hung from the upper wedge and free to revolve completely, change their seating position at each closing. This means uniform wear distribution. Valves work better and last longer, require less attention, less maintenance.

Wide Range Of Sizes And Types

If you're not already a Darling revolving disc gate valve user, let us prescribe the valve you need to cure *your* valve trouble. Darling gate valves come in a wide range of types and sizes . . . and for pressures up to 1500 pounds. Simply outline your particular service needs or ask for a complete descriptive bulletin.



Above, left: Disc and seats are parallel. No problem. Right: Seats out of parallel because of unequal expansion or contraction but discs adjust themselves to give positive closure. Still no problem! Radiused face of wedge allows discs to adjust tightly against both seats.

DARLING VALVE & MANUFACTURING CO.

Williamsport 9, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario

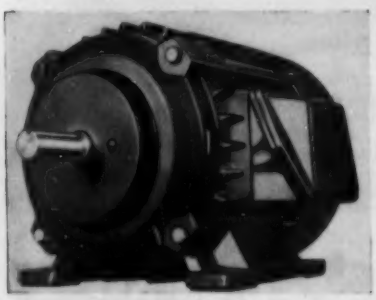
Circle 504 on Reply Card for more data

new equipment

. . . new developments

Fan features hollow-sectioned blades

C10 "Chicago" Airfoil Centrifugal Fans, Type A, designed by Chicago Blower Corp., are said to be the first major development in the field since development of the backward curve non-overloading type fan. The wheel is the backward curve type with air foil hollow sectioned blades. The fan operates at efficiencies above 90 percent and with less noise, than units using the conventional flat blade. It will deliver 600 to 750,000 cfm, ⅛ to 32 in. static pressures. Wheels are 12 to 123 in. dia. Detailed information is given in a bulletin.

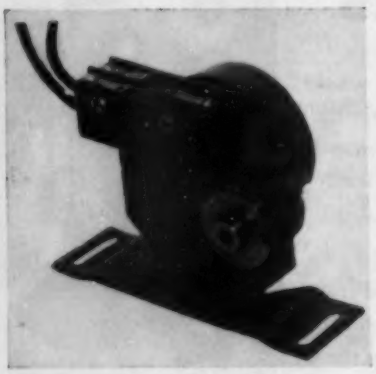


Motors are designed to new NEMA standards

C11 Built to new NEMA standards, the line of squirrel-cage induction motors designed by Reliance Electric and Engineering Co. includes protected and enclosed motors for all industrial purposes. The motors are said to feature greater horsepower in less space and better protection of motor windings, leads, and bearings. Now available in 1, 1½, and 2 hp, frame sizes 182 and 184, the balance of the line up to 30 hp will be introduced during 1954 and 1955. Informative "Compar-A-Frame Chart," is available.

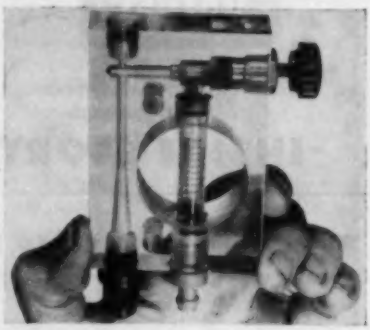
Snubbers for commercial service are added to line

C12 For more effective control of noise from internal combustion engines, the Petroleum-Chemical Div. of Burgess-Manning Co. is offering an improved snubber series: BEO (optimum service); BES (standard service); BEC (commercial service). BEO replaces and supplements STC snubbers; BES replaces SDG and ADL snubbers. BEC, which has no previous equivalent, is highly effective for turbo-supercharged engine exhausts. The ten models of the line are described in a bulletin.



Pulse frequency altered by changing gears

C13 Hagan Manufacturing Co., Inc., subsidiary of Eagle Signal Corp. announces the low cost Long Range Pulse Timer. Cams rotating at different speeds are said to provide accurate momentary pulses even when spaced considerably apart in respect to time. The frequency of pulses is altered by changing gears and may be set from 1 pulse every 15 sec to 1 pulse per week. The time between pulses can be up to 30 times greater on this unit than on a conventional timer having cams anchored directly to motor shaft without loss of rapidity of "make" and "break" contact action, diminutiveness of pulse and accuracy of pulse.



Feeder controls and mixes liquid chemicals

C14 The Feedrator, a rugged compact chemical feeder made by Fischer & Porter Co., includes a built-in ejector which eliminated the need for a proportioning pump. The unit will simultaneously meter, control, mix, and dispense small proportions of liquid chemicals into liquid streams. A pressure differential in the main line to create a by-pass flow through the ejector is all that is necessary to operate the unit. Reagent capacities range from .03 to 0.3 and 2 to 20 gal per hr.

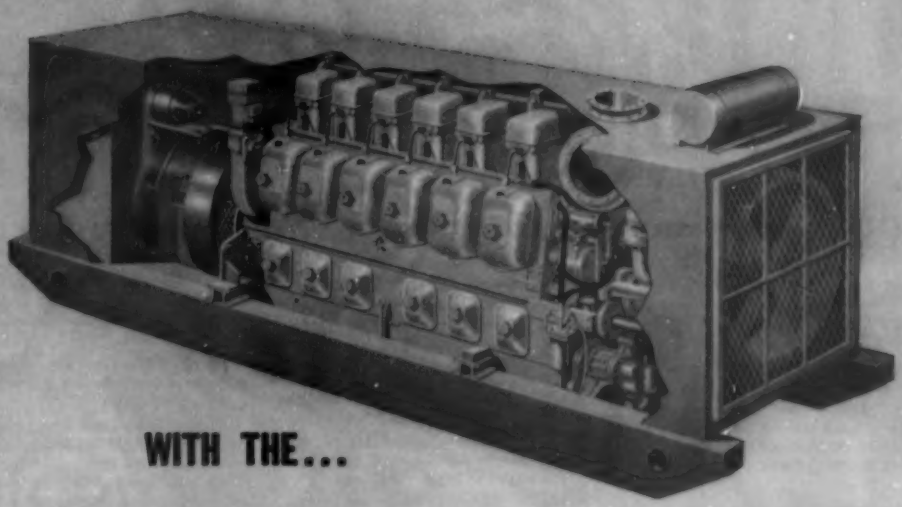
Rectifiers are lightweight

C15 Rectifiers, developed by Wagner Brothers, Inc. are said to accommodate any application requiring a positive source of continuously smooth dc at capacities from 5 to 50,000 amp. They are available in five basic models: large package unit, 2000 to 50,000 amp; water cooled, 1500 to 50,000 amp; small package unit, 250 to 2000 amp; cubicle, to 2000 amp; and bench type, 5 to 200 amp. Lightweight

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Circle this number on Reply Card, pages 36/37 & 100/101.

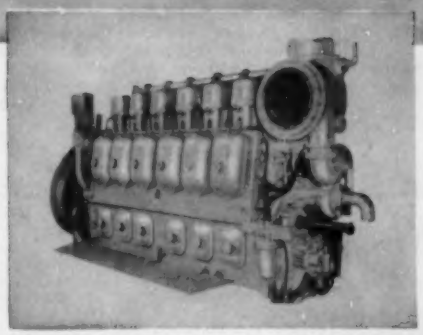
DEPENDABLE POWER

WHERE YOU WANT IT, WHEN YOU WANT IT



WITH THE...

NEW, PORTABLE ALCO DIESEL ELECTRIC GENERATOR UNIT



Alco 6-cylinder, 9" x 10½" (251-A), 4-cycle, turbocharged diesel engine, dry weight 21,350 lbs. Twelve- and 16-cylinder engines also available.

for

- ★ Emergency power generation
- ★ Power during construction or repair
- ★ Supplemental power during peak periods
- ★ Hospital or civil defense standby service
- ★ Scores of other municipal and industrial uses

Here's the answer to your demand for a compact, economical power generating unit for emergency, temporary or standby service.

A completely self-sufficient power plant, the new, portable Alco Diesel Electric Generator unit consists of a 9" x 10½", 4-cycle turbocharged Alco diesel engine, in sizes ranging from 390 to 1300 kw, with all necessary auxiliary equipment.

It can be rail-mounted for electric power *where* you want it, *when* you want it. It can be installed permanently for applications such as standby service in hospitals and municipal power plants.

Either way, it puts dependable power at your immediate call twenty-four hours a day.

ALCO DIESELS

AMERICAN LOCOMOTIVE COMPANY

SCHENECTADY, N. Y.

AMERICAN LOCOMOTIVE COMPANY
Erie Boulevard
Schenectady 5, N. Y.

Gentlemen:
Please send me complete information about the new Alco Portable Diesel Electric Generator Unit.

Name_____ Title_____

Company_____

Street_____

City_____ Zone____ State_____

Circle 505 on Reply Card for more data

Revolutionary Performance!

Riley Boiler Unit gives bonus of 20,000 pounds per hour of steam to Masonite Corporation

Here's the maximum capacity guaranteed to Masonite by Riley Stoker Corporation:

50,000 lb. continuous
60,000 lb. for 15 min. peaks

And here's the Masonite report on performance: "For the past 75 days the average hourly load on the new boiler has been 70,000 pounds with peaks of one and more hours' duration of 75,000 pounds."

This same installation called for a guaranteed air heater gas temperature not in excess of 395 degrees at 50,000 pounds of steam per hour. In actual operation at 54,500 pounds of steam per hour, the air heater exit gas temperature was only 377.5 degrees!

No wonder Riley Stoker Corporation, Worcester, Massachusetts, is so well known among leading plants throughout the nation for the highly efficient performance of its boilers!

Coppus-Dennis FANMIX Burners Were Installed

To assure such revolutionary performance, Riley specified Coppus-Dennis FANMIX Burners for its boilers. The exclusive FANMIX action — on *all* Coppus burners, gas as well as combination gas-oil — is the reason for such performances.

FANMIX : Better Combustion : Better Efficiency : Higher Ratings

FANMIX burners, with their *revolving orifices*, give violent mechanical mixing and agitation of gas and air and, therefore, instantaneous and complete combustion with *minimum excess air* (5% excess air not unusual).

Furnace space is not required for mixing; therefore, *higher boiler ratings* are easily obtained.

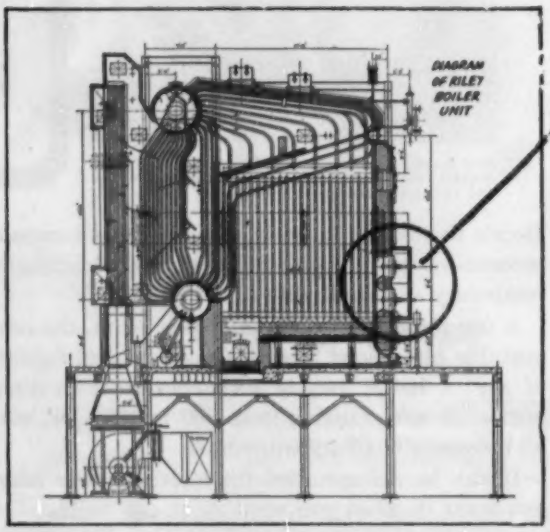
FANMIX burners, with shorter flame than any other burner, cannot cause flame impingement.

FANMIX burners, incorporating a *fan* as an integral unit, have *no draft loss* across the burner. Therefore, regardless of draft conditions, increased ratings are possible.

FANMIX action, with its quick completion of combustion, gives *lower* exit gas temperatures.

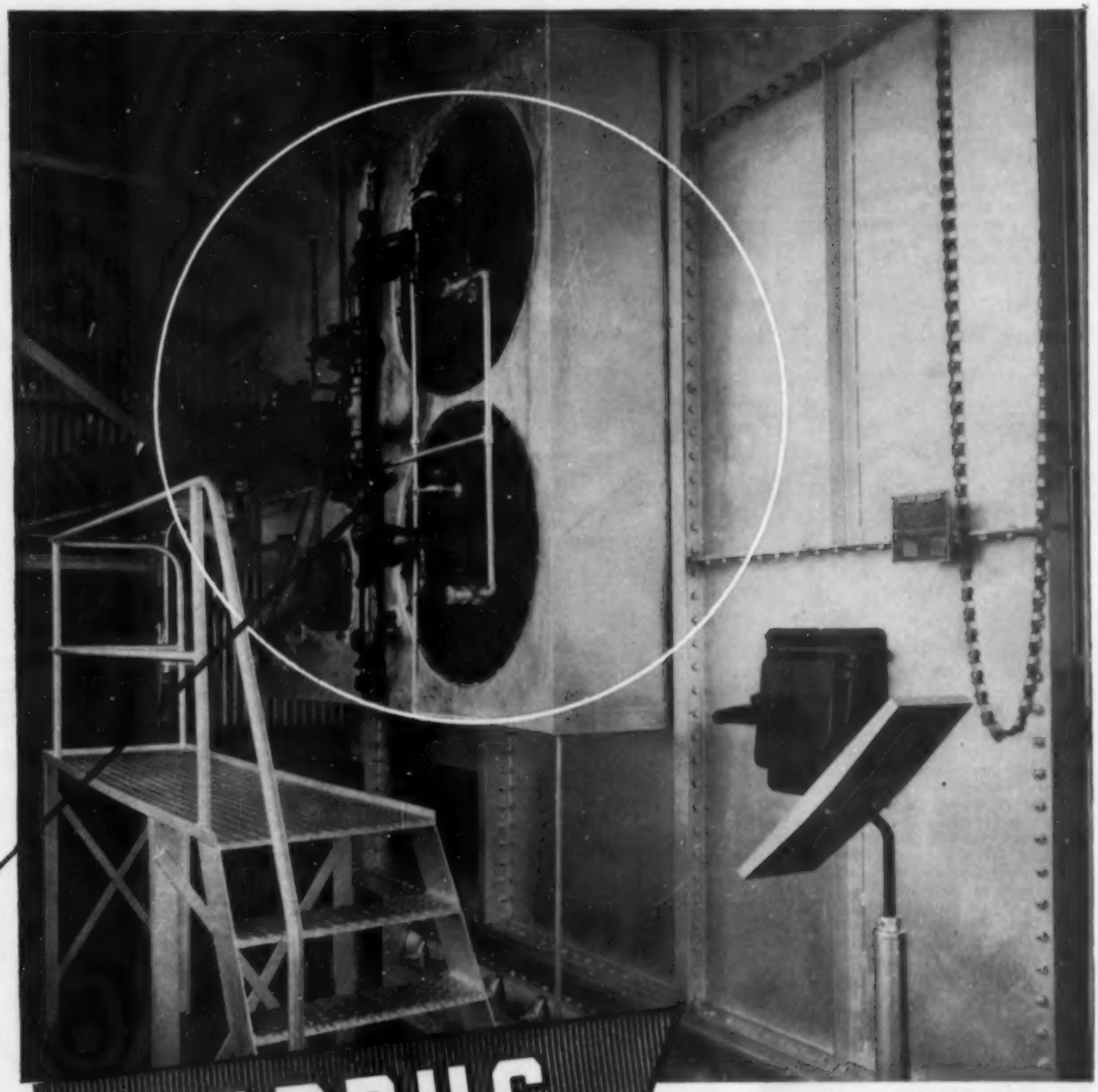
Plan now to take advantage of Coppus-Dennis FANMIX action with your present boiler. Remember — no forced draft equipment nor increase in stack nor increase in furnace volume is required for *FANMIX* operation to get increased capacity. And on *new* boilers, FANMIX lets you plan on reduced combustion space, higher ratings, less stack height or reduced induced draft capacity, and *no* forced draft equipment. Mail coupon today. Sales offices in *Thomas' Register*. Other "Blue Ribbon" Products in *Chemical Engineering Catalog*, *Refinery Catalog*, *Best's Safety Directory*, and *Mining Catalogs*.

JET REACTION is utilized to rotate fan which is integral part of burner. Automatically proportioned high velocity air passes at right angles through fuel to create ideal mixture for fast, complete combustion and peak efficiency.



Well-Known Users of Riley Units with FANMIX Burners Include:

Publicker Commercial Alcohol Co.
Monsanto Chemical Co.
Gaylord Container Corp.
Commercial Solvents Corp.
Celanese Corp. of America
Gulf Power Co.
Mississippi Power Co.
Eagle-Picher Lead Co.
Humble Oil & Refining Co.
Godchaux Sugars, Inc.
Kennecott Copper Corp.
Nicholson File Co.
Bird & Son, Inc.
— and many others



RILEY BOILER UNIT, using FANMIX burners, is here shown as installed for the Masonite Corporation, Laurel, Mississippi. Circle in diagram at left indicates position of burners pictured above.

SEND COUPON for further information. Coppus engineers FANMIX burners to your individual requirements.

PLEASE ATTACH THIS COUPON TO YOUR COMPANY LETTERHEAD

COPPUS ENGINEERING CORPORATION
183 Park Avenue
Worcester 2, Massachusetts

Please send complete data on Coppus-Dennis FANMIX Burners. I'm particularly interested in
☐ gas ☐ combination gas-oil.

Name..... Title .....

Company.....

Address.....

City..... Zone..... State .....

Circle 506 on Reply Card for more data

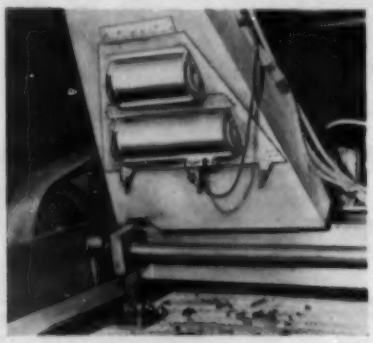
new equipment

—Starts on page 8

supports or foundations unnecessary. They can be connected in series, parallel, or series-parallel for practically any output of d-c power. All units are easily modified to meet particular requirements.

Re-design simplifies centrifugal fan ventilator

C16 Mechanical improvements and complete redesigning of their Airlift centrifugal fan ventilator is announced by The Swartwout Company. A new one-section hood—lifting on swing-hinges in smaller models and removable on large sizes—covers motor chamber and directs air exhaust downward for dispersion over roof. Removal of the hood provides easy access to motor and fan chambers for servicing and cleaning. Designed primarily for low noise level duct exhaust, the Airlift is cataloged in 14 sizes and a wide range of available capacities at static pressures from 0 to ⅜ in.



Alarm system increases separator efficiency

C17 Eriez Manufacturing Co. announces the Magnalarm, a completely automatic alarm system which increases the efficiency and usefulness of magnetic separators by virtually eliminating the possibility of human error. A sensitive ferrometer measures tramp iron as it accumulates on the magnet's surface, and reacts on a circuit to trip the alarm as soon as a predetermined accumulation is reached. Types of alarms — lights, bells, buzzers — are optional.

Handling costs reduced with magnetic conveyor

C18 The Rapistan "MP" magnetic parts and scrap belt conveyor announced by The Rapid-Standard Co., Inc. is designed to operate with low discharge presses and is said to affect substantial handling savings. Permanent magnets mounted under the bed of the unit attract and hold iron and steel parts in position as they move up the belt. The 24 x 30 in. base, equipped with four 3½ in. dia wheels, can be shoved under most wheeled tote trucks, with parts dropping from the conveyor overhang into container. The conveyor is powered by a ½ hp motor through a 20 to 1 spur gear reducer.

Speed reducer is of all-steel construction

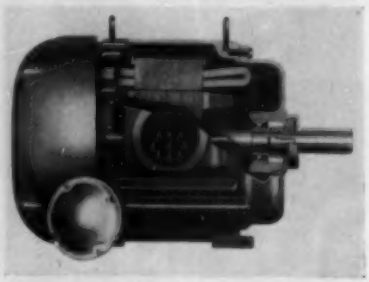
C19 The Falk Corp. announces an all-steel speed reducer which mounts directly on the shaft to be driven and requires no floor space other than that needed for the motor and tie rod connection. Easily adapted to fit various driven shaft diameters, a choice of single or double reduction unit makes possible the selection of almost any output speed between 420 and 14 rpm, by changing sheave sizes within allowable limits. Six sizes cover the range from ½ to 30 hp.

Control packages are individually designed

C20 Complete control packages, individually designed for specific furnace, oven, kiln or dryer applications, are announced by The Bristol Co. These Bristol-Beck control packages are designed to operate on-off or proportional fuel valves or electric contacts, in a variety of control systems, including proportional, proportional-input, on-off, or time-program. Automatic reset is also available. They include all components necessary for a complete installation, including a Dynamaster Pyrometer, a Beck Relay or Putmo Controller, and a Beck Motor Operator. A Bulletin is available.

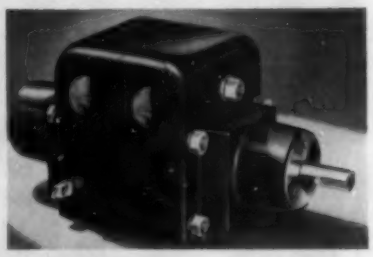
Cutting-oil is improved

C21 Improvements in Sunoco emulsifying cutting oil is announced by Sun Oil Co. SECO is said to mix more easily with hot, cold, and hard water also and to form whiter and more stable emulsions. The lower viscosity makes it easier to handle, and its increased detergency improves its efficiency as a grinding oil. It is also said to be ideal for use in hot emulsion-type washers, for hot rustproofing, for cold rolling steel, and for many other metalworking applications. A technical bulletin is available.



Dust-proof motor is self-cleaning

C22 Crocker-Wheeler Div. of Elliott Co. announces a special modification of its CFC Sealedpower totally-enclosed, fan-cooled model. It features nonferrous slingers and bushings, a heavy fibrous grease seal, prelubricated and sealed ball bearings, and long, close tolerance fit between bearing brackets and frame. Leads are sealed in with an air-hardening plastic, and the motor is selfcleaning with its fan driven cooling air directed along the heat radiating fins. A descriptive bulletin is available.



Pump is for corrosive service

C23 Precision molded synthetic rubber pump casings are featured on the Rubberchem displacement pump announced by Eco Engineering Co. Embodying the design and features of the stainless steel and Teflon All-Chem pump, these units are suitable for corrosive fluids and capacities up to ten gpm at 100 psi for sustained service. Internal parts are available in Type 316 stainless steel or monel.

Condenser line is expanded

C24 Evaporative condensers of the blow-through type are now available from Drayer-Hanson, Inc. in

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Betz Water Conditioning Service is based on the policy that nothing is left to chance. There are no mere guesses or assumptions that conditions are satisfactory at a client's plant.

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At regular intervals, water samples from important points throughout the plant system are secured by our engineers and forwarded to our modern laboratories. Here, experienced chemists analyze each sample until it literally breaks down and "admits the facts".

Such painstaking analyses often reveal conditions which may not be evident from plant control tests. It permits our Engineering Division to make corrective recommendations *well in advance*, thereby heading off any serious trouble which might develop. This, too, is *another* important part of Betz *completely-integrated* water conditioning service.

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CONSULTANTS ON INDUSTRIAL WATER PROBLEMS

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For LOW-COST UPJOHN burns COAL

UPJOHN'S new pharmaceutical plant which includes units for production of penicillin and cortisone, as well as some 700 other pharmaceutical products, relies on coal for dependable steam.

This ultramodern boiler house supplies steam, cleanly and efficiently, at only 40¢ to 42¢ per 1,000 lbs. It delivers 115,000 lbs. per hour at peak load for the Portage Road Plant near Kalamazoo, Michigan.

There are no dust or smoke nuisances, thanks to the dust collecting and cinder re-injection system.

For both efficiency of operation and economy, you just can't beat coal burned the modern way!

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

FOR HIGH EFFICIENCY
FOR LOW COST

DEPENDABLE steam, the modern way!

CLEAN, CONVENIENT!
This view of Upjohn's firing aisle shows how clean and convenient coal can be when handled and burned the modern way. The stoker hoppers are fed from an overhead bunker. A 2-ton capacity weigh larry serves all boilers.

The ash handling is fully automatic. Traveling grates continually discharge ashes into hoppers below the floor of the firing aisle.

The 3 boilers shown, plus a fourth recently installed (not illustrated), supply all Upjohn's steam needs.

• Whether you're building a new plant or modernizing an older one, you can count on coal for dependability and low-cost operation.

Here's why: Up-to-date coal-burning equipment can give you 10% to 40% more steam per dollar. Automatic coal- and ash-handling systems can cut your labor cost to a minimum. Let a consulting engineer show you how a modern coal installation, tailored for your specific needs, can save you real money.

Here's something else, too—of all fuels, coal alone has virtually inexhaustible resources. This, plus the fact that America's coal industry is the most efficient in the world, assures you of a dependable supply of coal at relatively stable prices now and for years to come.

BITUMINOUS COAL INSTITUTE
A DEPARTMENT OF NATIONAL COAL ASSOCIATION
WASHINGTON, D. C.

YOU CAN COUNT ON COAL!

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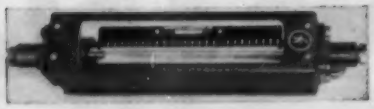
new equipment

—Starts on page 8

an improved and expanded variety of arrangements known as Series PF (Perma-Fan), Type C. Included are advances in housing construction, eliminators, headering, pumps, sump pan drainage, and finish. Eliminators may be serviced without disturbing dust connections. Units are equipped with separate direct-connected motor driven pumps. In capacities ranging from 5 to 65 tons, these units are for either outdoor or indoor installation and have the advantage of complete field disassembly.

Valves maintain constant back pressure

C25 Type KD automatic back pressure control valves, developed by A. W. Cash Valve Manufacturing Corp., are said to automatically maintain a constant back pressure on the inlet side, regardless of variation of pressure at the valve outlet or changes in demand or flow. They are available in pipe sizes ¼ to 2 in., screwed ends, with or without a handwheel for manual pressure adjustment.



Rotameter features safety and convenience

C27 As an answer to industry's increasing demands for safety and convenience in rate-of-flow measurement of liquids and gases, Schutte and Koerting Co. has designed the Safeguard Rotameter. A completely enclosed steel meter case with detachable safety glass windows protects the metering tube from external shock and so acts as a safeguard in the event of accidental tube breakage. Standardized construction permits the use of up to four sizes of meter tubes in one meter case. The variety of rotor designs available afford a wide range of capacities within one meter size. The units can be adapted for electric or pneumatic transmission and remote recording of fluid rate of flow. A bulletin is available.

TO REQUEST FREE BULLETINS

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Transmitter-receiver is mounted on forklift trucks

C28 For the materials handling field, Farmers Engineering and Manufacturing Co. has developed the Femco Carrier-phone. The system consists of a compact, mobile transmitter-receiver unit mounted on forklift-trucks or tractors for two-way communication with a central dispatcher. The transreceiver unit is small in size and operates from a truck battery. Several frequencies are available to provide localized communication systems. Use of carrier frequencies instead of radio keeps the circuit free from interference by other transmitters. No Federal Communication Commission licenses are required and maintenance can be performed by non-licensed repairmen.

Electric hoist has two-ton capacity

C29 Available with either two-speed or single speed push button magnetic control, the J-3 electric wire rope hoist announced by Hoist and Crane Div. of Robbins & Myers, Inc., has a rated capacity of two tons. It is powered by a two hp totally-enclosed, ball bearing motor designed and manufactured by this company for hoist duty and is equipped with two parts of ⅜ in. cable, 6 x 37 reeving. It has an 18-ft lift without overwind; overwinding allows a 25-ft lift. Upper and lower limit switches prevent overtravel of the hook block in either direction. The J-3 is available with plain, hand geared, or motor driven trolley to meet the needs of any application.

Rubber-leather packing meets many service needs

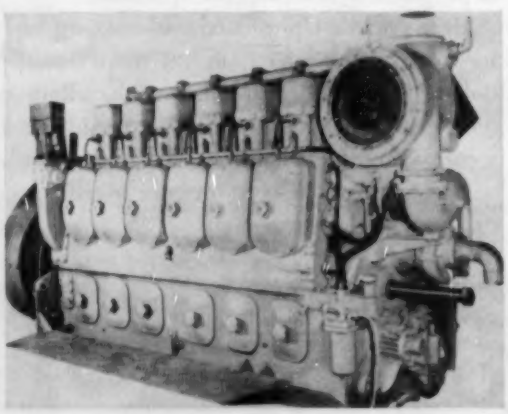
C30 Rubber-impregnated leather packing combines the longer life and lower friction of leather with the non-porosity, high resiliency and heat resistance of synthetic rubber, according to the manufacturer, E. F. Houghton & Co. Known as the VIM 1243 Type 3 packing, it is a pre-set, pre-cured, and scientifically proportioned packing with unusually high dimensional stability. Since the synthetic rubber impregnant in the packing has

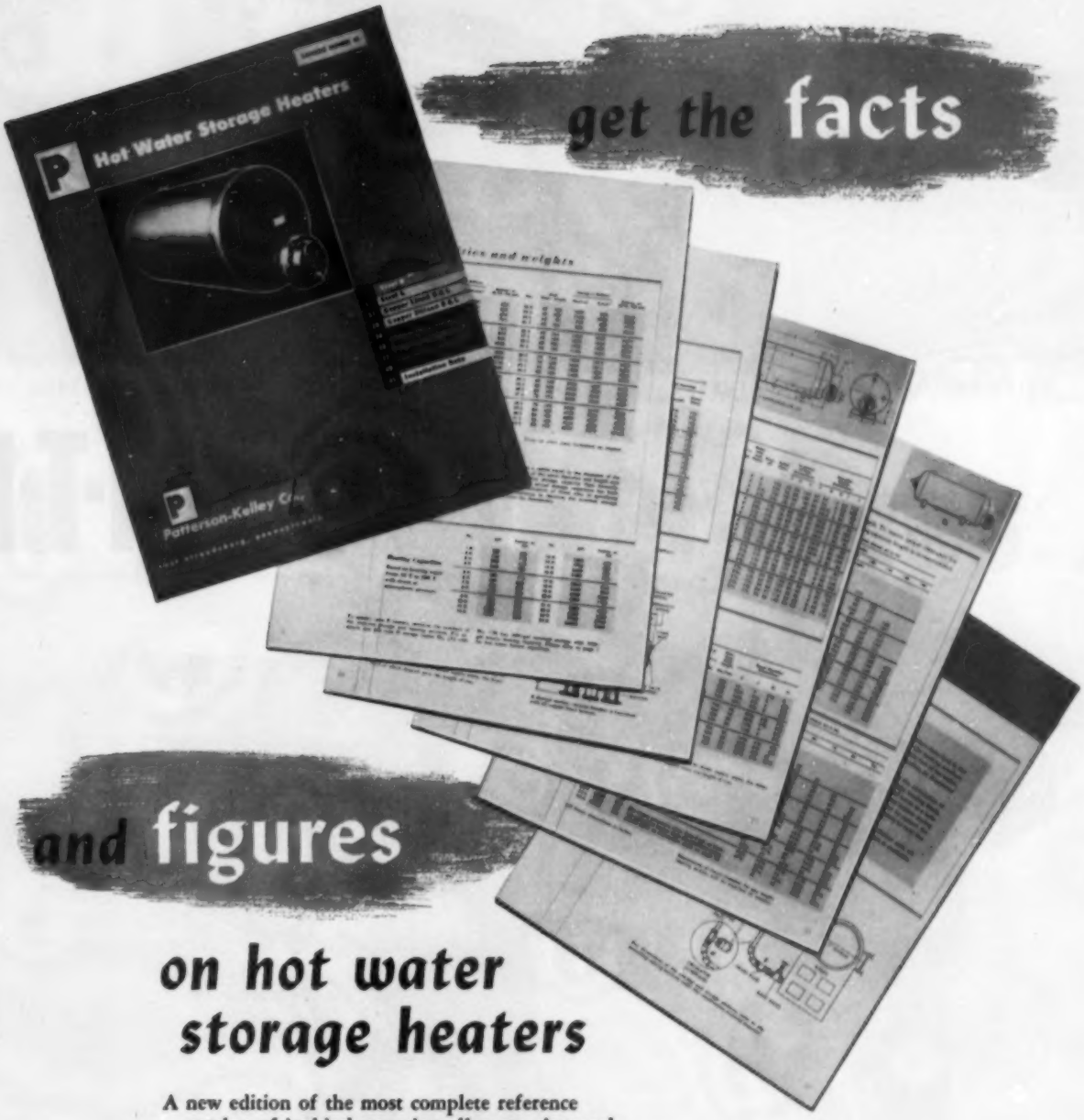
Diesel-electric unit is mounted on skids

C26 Utilizing the type engine proved on thousands of American Locomotive Co. diesel locomotives, this company's new generator can be equipped with a 9 x 10½ in., 4-cycle, turbocharged Alco diesel in sizes ranging from 390 to 1300 kw. Twelve and 16-cylinder engines are also available. The generator on the six-cylinder engine is a high-speed type with one outboard bearing mounted in the end shield. On the 12- and 16-cylinder units, the generator is of the engine type with a pedestal outboard bearing.

In addition to the engine, all auxiliary equipment including generator, exciter and switch gear is mounted on skids so that by merely connecting the power cables, the unit is ready for operation. The entire power plant can be enclosed in a weather-proof housing eliminating the need for separate building facilities or other protective structures.

The design of the Alco portable generator can also be adapted to pipeline service, flood control and irrigation uses by substituting step-up gears and pumps for electric generating equipment. Because of this versatility, the unit is well suited to many types of portable power service.





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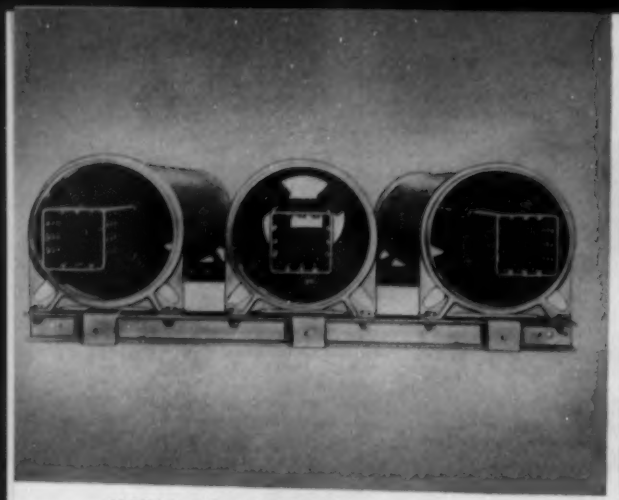
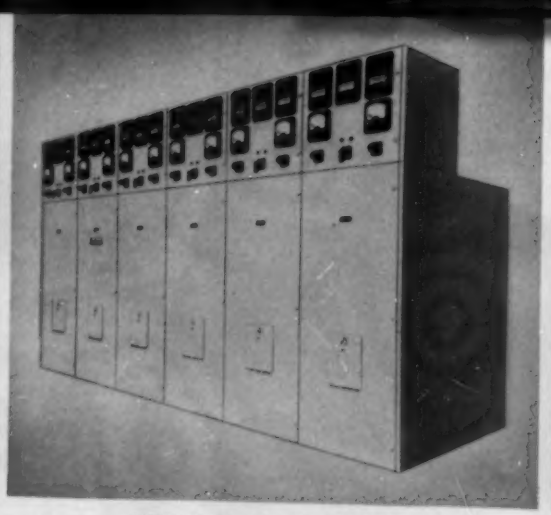
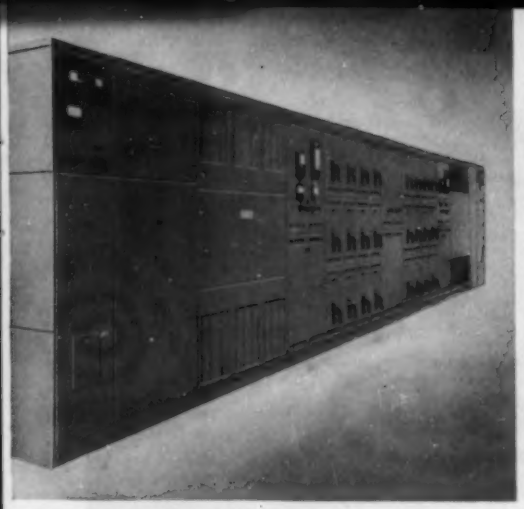


METAL-ENCLOSED BUS STRUCTURES

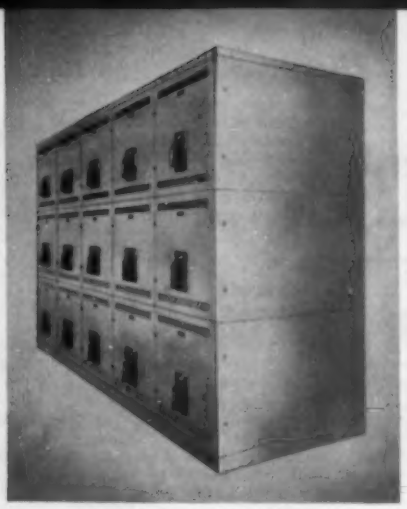


METAL-CLAD SWITCHGEAR

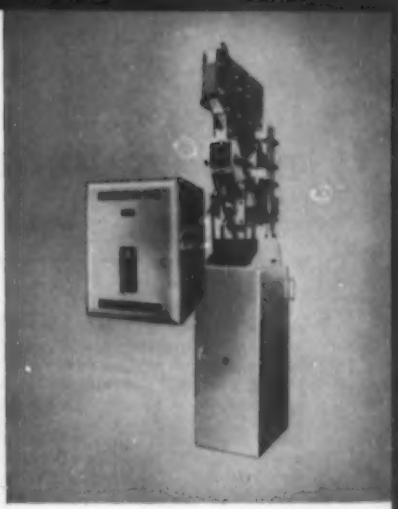
Put I-T-E



UNIT SUBSTATIONS



LOW-VOLTAGE SWITCHGEAR



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for Dependability, Safety, and Over-all Economy

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From generation to utilization, I-T-E quality equipment serves every industrial and commercial application. Whether your plans include bus structures, metal-clad or low-voltage switchgear, unit substations, or individual circuit breakers—you are assured of I-T-E's many *extra-service* benefits, which include:

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Power is fundamental in any new plant construction or expansion. Power distribution systems must be planned to assure maximum dependability of service, safety for personnel and equipment, and *over-all* economy—from initial planning . . . through the life of the equipment.

Furthermore, it is important to plan power systems with an eye to the future. They should be adaptable to changing plant requirements for many years ahead.

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SWITCHGEAR PRODUCTS

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new equipment

—Starts on page 8

no melting nor miscibility point, it will serve at temperatures up to 200 F. It has withstood temperatures as low as –65 F, and will operate within a pressure range of zero to 15,000 psi. Pliability of this packing is said to permit easy installation and a tighter than usual seal. It has high abrasion resistance and exceptional resistance to oils and solvents.

Power drive is portable

C31 No. 142 Featherweight Champ power drive for hand pipe tools weighs only 75 lb and can be moved and used easily by one man. Manufactured by Oster Manufacturing Co., the unit is available with either gas or electric power and has a threading range of ⅛ to 2 in. The motor is ½ hp continuous duty universal, reversible, variable speed. Illustrated literature is available.

No fans are required for infrared generator

C32 Heavy-duty infrared generator for high-intensity heating requirements announced by Edwin L. Wiegand Co. has been especially designed and constructed for web-fed processes in the paper, plastics, and textile industries.

Measuring 66 x 12 in., the Chromalox heating panel's output can be easily controlled from 4 to 100 percent of 15 kw capacity, with element temperature up to 1450 F. Standard voltages are 240 and 480, while special panels of other watt ratings and voltages up to 600 v can be made to order. No fans or cooling equipment are required as the panel is designed to operate at 700 F on the work. Literature is available.

Separator cleans oils and coolants

C33 Fully automatic removal of ferrous solids from cutting oils and water soluble coolants is said to be possible with use of a complete package unit made by the Industrial Filtration Div. of U. S. Hoffman Machinery Corp. This Magnaflo Separator removes 75 to 90 percent of solids in a relatively dry sludge for easy disposal. Two of the five sizes are designed to serve individual machine tools with 20 to 40 gpm flow rate requirements. Three larger sizes are intended for small groups of grinders with total flow rate requirements ranging from 60 to 100 gpm.

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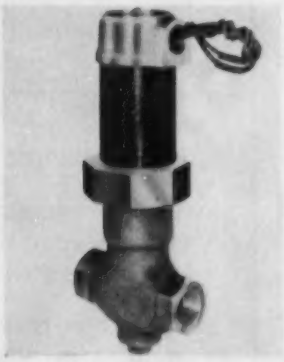
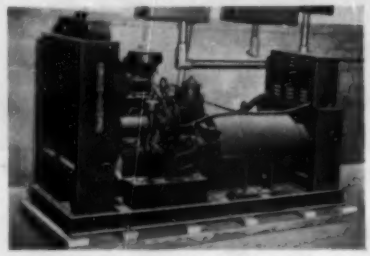


Valves are cast iron and steel construction

C34 Designed for handling media normally injurious to bronze or brass but not harmful to ferrous metals, a line of cast iron and cast steel solenoid valves has been introduced by Atkomatic Valve Co. The valves are available in sizes from ½ to 2 in. Pressures range to 1000 psi at 200 F; 500 psi at 450 F. A technical bulletin gives more information.

Hydraulic operator is coupled with trip-free linkage

C35 Simplified hydraulic operating mechanism coupled with a mechanical trip-free linkage provides improved energy for circuit breakers according to the General Machinery Div. of Allis-Chalmers Manufacturing Co. The five-gal capacity accumulator with a peak capability of 400 hp is said to have an efficiency of more than 99 percent. In a life test consisting of 6000 closing and reclosing operations of the new system's complete operating mechanism, including controls, no changes in operating characteristics, leakage rate, or component failures were revealed.

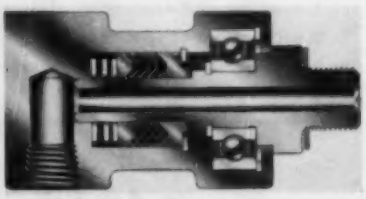


Fuel consumption is low for package unit

C36 Ready-Power Co. announces a new generator series powered by Chrysler engines. Including three sizes of 50, 30, and 20 kw ratings, each unit is a complete, packaged generating plant ready for operation. Controls for engine and generator are in a single cabinet. The units are said to be economical in fuel consumption. The welded structural steel base assures easy installation and permanent alignment without need of a special foundation.

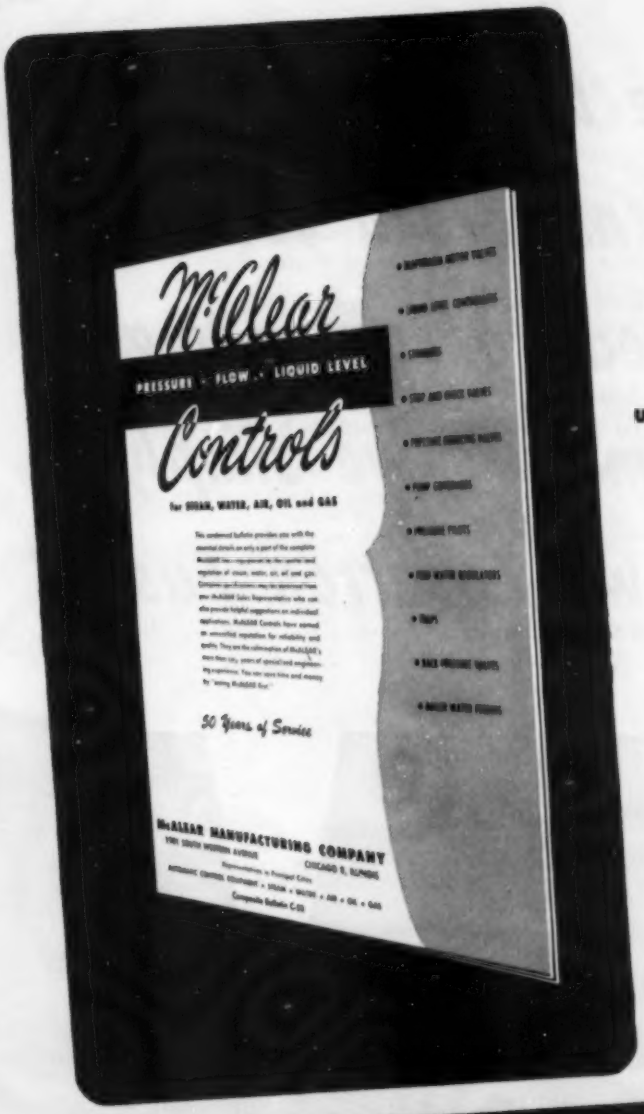
Mounting pads keep machines level

C37 Machinery mounting pad Type T Unisorb, made by The Felters Co., is said to have greater firmness than similar pads produced to date. For use in mounting machines which must remain level during operation, the ½ in. thick material is said to carry a load of 75 to 125 lb per sq in. and is completely resistant to petroleum products, mild acids, and moisture conditions found in most plants.



Joint is for air or hydraulic service

C38 Introduction of an improved, light running Revolving Joint with ¼ in. ID for making air or hydraulic piping connections to rotating machine parts is announced by Barco Manufacturing Co. Known as Type NV, the joint is suitable for use at temperatures up to 180 F and pressures to 300 psi (air) or 1500 psi (hydraulic). Maximum speed ordinarily



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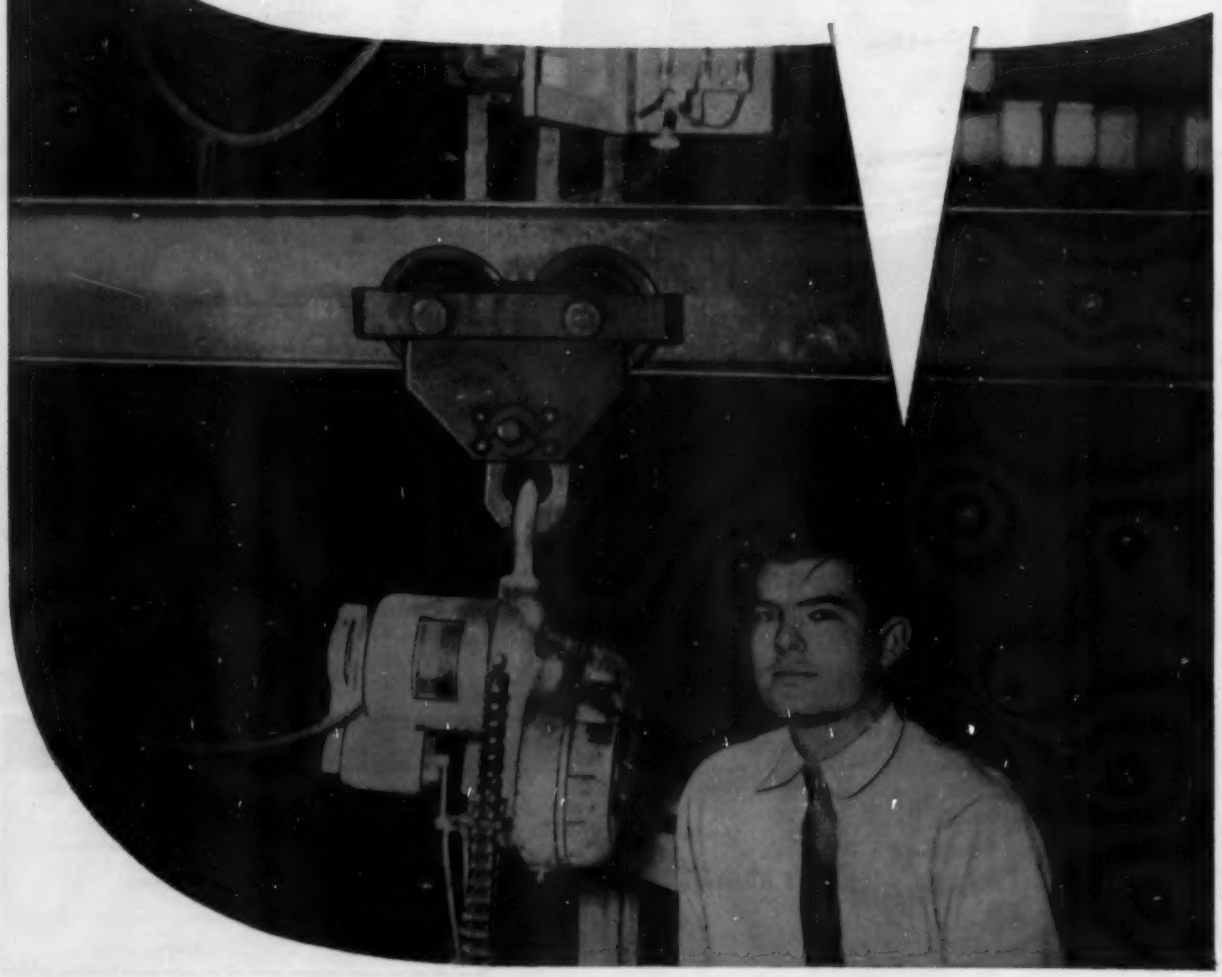
"We were losing as many as six hoist motors a year— now instead of rewinding burned out motors we simply replace blown Fusetron Fuses"



"WE have two 1 ton hoists that are subject to very heavy loading. The motors on these hoists are 220 volt, 60 cycle, 3 phase type with a running current of about 3.7 amperes.

"Whenever the hoists are overloaded an excessive current is drawn by the motor. We have lost as many as six motors a year because of this.

"In the fall of 1952 we replaced all fuses protecting the motors with 4 ampere, 250 volt type FUSETRON dual-element fuses.

"Since then we have blown three sets of FUSETRON fuses but have not lost a single motor.

"So now instead of rewinding motors we simply replace blown FUSETRON fuses.

"They are a lot cheaper than a motor repair job — and we don't have our hoists shut down but for a few minutes while the fuses are replaced."

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Production Superintendent.
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FUSETRON dual-element fuses can save you money in more ways than protecting motors — they give 10 point protection.

1 *Protect against short-circuits.
2 Protect against needless blows caused by harmless overloads.
3 Protect against needless blows caused by excessive heating—lesser resistance results in cooler operation.
4 Provide thermal protection—for panels and switches against damage from heating due to poor contact.
5 Protect motors against burnout from overloading.
6 Protect motors against burnout due to single phasing.
7 Give DOUBLE burnout protection to large motors — without extra cost.
8 Make protection of small motors simple and inexpensive.
9 Protect against waste of space and money — permit use of proper size switches and panels.
10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York.

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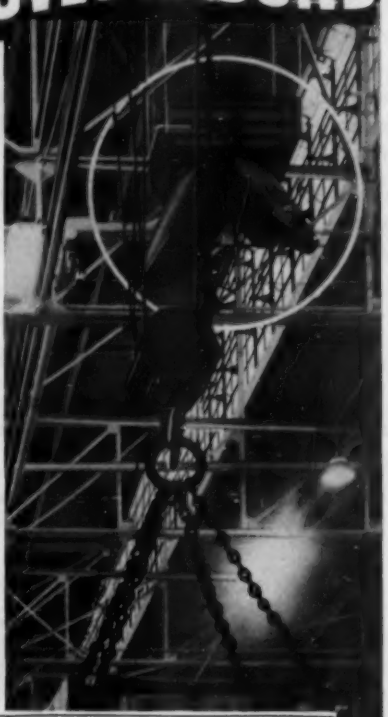
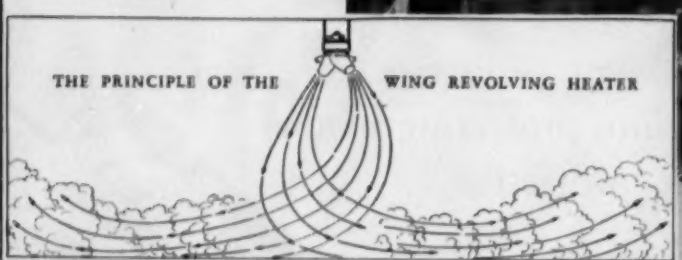
HEAT THAT MOVES AROUND

THE fact that the discharge outlets of WING Revolving Unit Heaters keep the heated air in constant, gentle motion is one of the reasons why nationally known firms like the Budd Company have installed them in their plants, both at Philadelphia and in the one shown in this photograph, at Gary, Indiana. The big blanking and forming presses in this great plant present a natural barrier to ordinary fixed discharge heating systems, but not to the moving streams of heated air from the WING Revolving Heaters, even suspended, as they must be, far above the floor, to clear the cranes. That is equally true in the summer time when, with steam turned off, the cooling breezes from the revolving discharge outlets keep workers comfortable on the hottest days. Investigate. Write for Bulletin HR-6.





The moving streams of heated air (or cooling breezes in summer) sweep slowly around through 360 degrees, covering successively every direction. The air velocity is sufficient to carry to walls, and remote corners and the constantly changing direction of flow causes the air to find its way around obstructions.

Wing

L. J. Wing Mfg. Co.
139 Vreeland Mills Road
Linden, New Jersey
Factories: Linden, N.J. and Montreal, Can
In Europe: Etab. WANSON, Brussels, Belgium

Circle 513 on Reply Card for more data

new equipment

—Starts on page 8

recommended is 2500 rpm for normal applications with lower speeds for high pressure and temperature conditions.

Adhesive outperforms heavy-duty clamp

C39 Placco 1000, extra-strong adhesive, has demonstrated through extensive on-job experience that it can out perform heavy-duty nails, screws, bolts, and clamps in many jobs, according to the manufacturer, Pioneer Latex and Chemical Co. A quick setting, heavy bodied, rubbery material, it has been used successfully for bonding to wood, masonry, and metal such items as hangers for wire, pipe, and conduits; nailing strips; electrical wiring fixtures; and all types of wallboards and flooring materials.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pgs. 36/37 & 100/101. Your requests will be handled promptly.

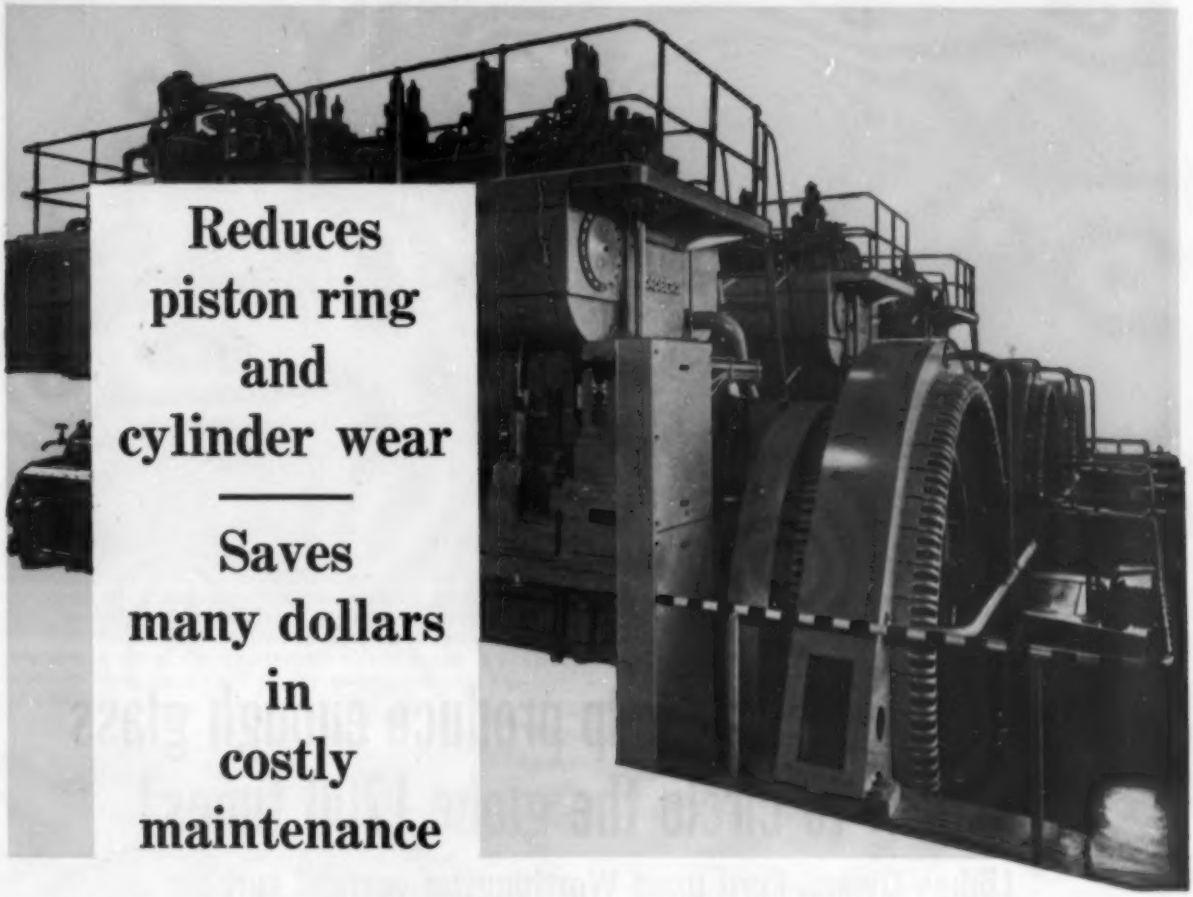
Cleaning tool does three jobs

C40 The 3-way Maintainer, manufactured by Wilshire Power Sweeper Co., blows down, picks up, and sweeps. It is said to enable one man to do the work of an entire maintenance crew. An illustrated folder is available.

Sealing compound is for low temperature service

C41 Eco Engineering Company's Chemical Products Div, announces that T-FILM, the Teflon-base thread-sealing compound, can now be furnished with added dry pigment lubricants, such as graphite, molybdenum sulfide, lead, or copper. Stabilized pig-

Shell Rotella Oil



Reduces piston ring and cylinder wear

Saves many dollars in costly maintenance

These dual-fuel engines in the Municipal Power Plant at Houma, Louisiana, supply dependable, low-cost electric power to the entire city. Shell Rotella Oil is the cylinder lubricant.

Here's just one of the many diesel power plants that depend on SHELL ROTELLA OIL for reduced wear of engine parts . . . lower maintenance cost.

The anti-corrosive action in Shell Rotella Oil combats the major cause of engine wear . . . cylinder and piston ring wear caused by acid action from the by-products of incomplete combustion and condensation.

Tougher lubricating film in Shell Rotella Oil gives cylinders and rings greater protection . . . minimizes wear. Its effective detergent-dispersant action prevents harmful deposits.

Write for technical information. See for yourself how Shell Rotella Oil can help reduce your engine maintenance costs.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK

100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

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WATER FOR PROCESSING FIBER GLASS is brought from deep wells by these six Worthington vertical turbine pumps at the Libbey-Owens-Ford factory in Parkersburg, W. Va. Any type of drive can be used with the pumps.

Daily, these pumps help produce enough glass filament to circle the globe 1700 times!

Libbey-Owens-Ford uses Worthington vertical turbine pumps in manufacture of fiber glass

In Parkersburg, West Virginia, the new Fiber-Glass Division of Libbey-Owens-Ford spins over 42 million miles of fiber glass filament every day.

All the water used for cooling and making process steam in this vast operation is supplied by six Worthington vertical turbine pumps. The pumps, with a capacity of over 6,000 gallons per minute, are used on cooling tower service.

Like other leading names in industry, Libbey-Owens-Ford has found that Worthington vertical turbine pumps can provide the most economical solution to many plant pumping needs. Refineries, chemical plants, pharmaceutical plants, manufacturing plants—all are turning to these modern pumps as a really dependable means of delivering water.

If you are faced with the problem of pumping hot water or volatile liquids, write for Bulletin W-450-B39 to Worthington Corporation, Vertical Turbine Pump Division, Harrison, N. J., and find out about the Worthington vertical turbine pumps for yourself. D.3.15

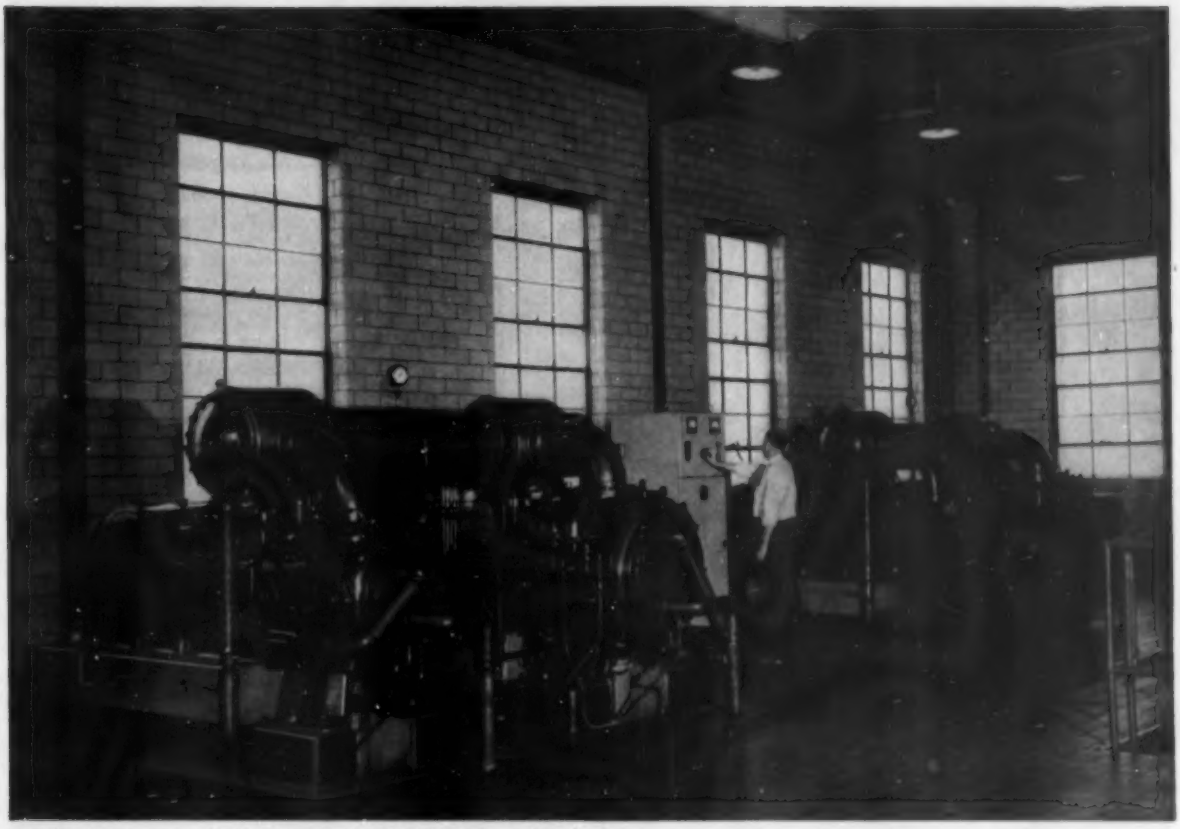
WORTHINGTON

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB

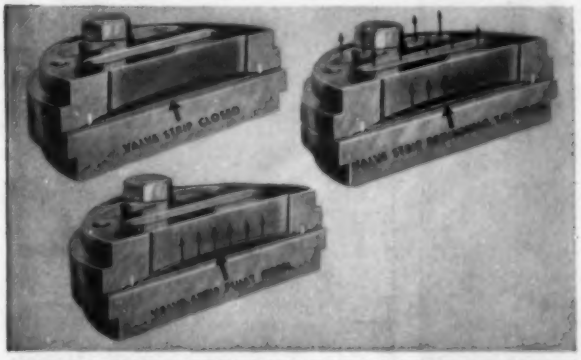
CENTRIFUGAL • ROTARY • STEAM • POWER • VERTICAL TURBINE

CONSERVE GROUND WATER—IT IS A VALUABLE RESOURCE

Circle 515 on Reply Card for more data



PERFECTION STOVE'S ULTRA-MODERN POWER PLANT is equipped with two Worthington DC-2 air compressors, each with a capacity of 1000 cfm.



QUIET-OPERATING WORTHINGTON FEATHER* VALVE is made up of a series of thin flexible strips of ribbon steel, held in position over rectangular openings by curved milled guards. The valve strips lift and flex uniformly against the curved guards. In addition to quiet operation, the absence of impact results in long valve life and low maintenance costs.

Perfection called for the finest in air compressors

• The Perfection Stove Company's new Ivanhoe Road power house in Cleveland has received national recognition as a leading example of modern, medium-size power plant design.

Every piece of equipment in this million-dollar plant had to meet the rigid specifications of Perfection's engineers. That's why, when it came time to supply compressed air for general plant use, two Worthington DC-2 horizontal air compressors were selected.

By installing these modern Worthington compressors, Perfection engineers made sure they would get lowest-cost compressed air and longest compressor life. The exclusive Worthington Feather* Valve—the lightest, tightest, most efficient valve made—is largely responsible for that.

Take a tip from Perfection Stove and find out for yourself about the Worthington line of air compressors. Write to Worthington Corporation, Compressor Division, Section K.3.7, Buffalo, N. Y. **Reg. U. S. Pat. Off.*

K.3.7

WORTHINGTON

Only Worthington Compressors give you Feather Valve Performance

Y-Types • Balanced Angle • Horizontal • Portable • Radial • Gas Engine Compressors

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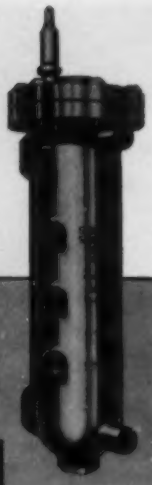
Engineered

FOR SAFER AND MORE EFFICIENT REGULATION OF BOILER WATER LEVEL



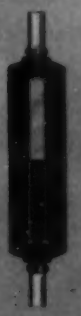
Safety Alarm Water Columns

BOILER TRIM

Low to High Pressure Gauge Valves

new catalog no. 700

WRITE FOR YOUR COPY TODAY



Reflex Gauges for High Pressures

● For 57 years Wright-Austin has concentrated on the manufacture of highest quality steam specialties. Our familiarity with steam users' requirements assures you of thoroughly practical designs in a complete line of Traps (cat. #600), Separators (cat. #500) and Boiler Trim (cat. #700).

Weighted and Compression Type Trycocks

WRIGHT-AUSTIN COMPANY

3245 WIGHT STREET • DETROIT 7, MICH.

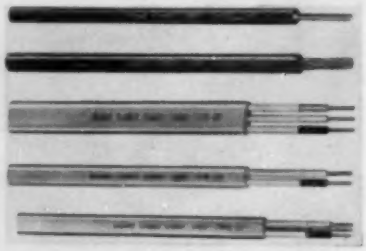
WA Standard and STEAM USERS SINCE '94

Circle 517 on Reply Card for more data

new equipment

—Starts on page 8

ment dispersions provide for lower sealing torques, especially in low temperature applications. It is suitable for temperatures from below zero to 400 F. Two oz will seal between 30 and 40 joints in one inch pipe.



Cable is for use in damp or corrosive service

C42 Low-cost, versatile cable for branch and feeder circuits is announced by the Rome Cable Corp. Known as Rome FlexAll, it is designed especially for underground feeder service, and for installation in locations where dampness or corrosive action are encountered. It is available in single, two, and three conductor

TO REQUEST ADDITIONAL DATA

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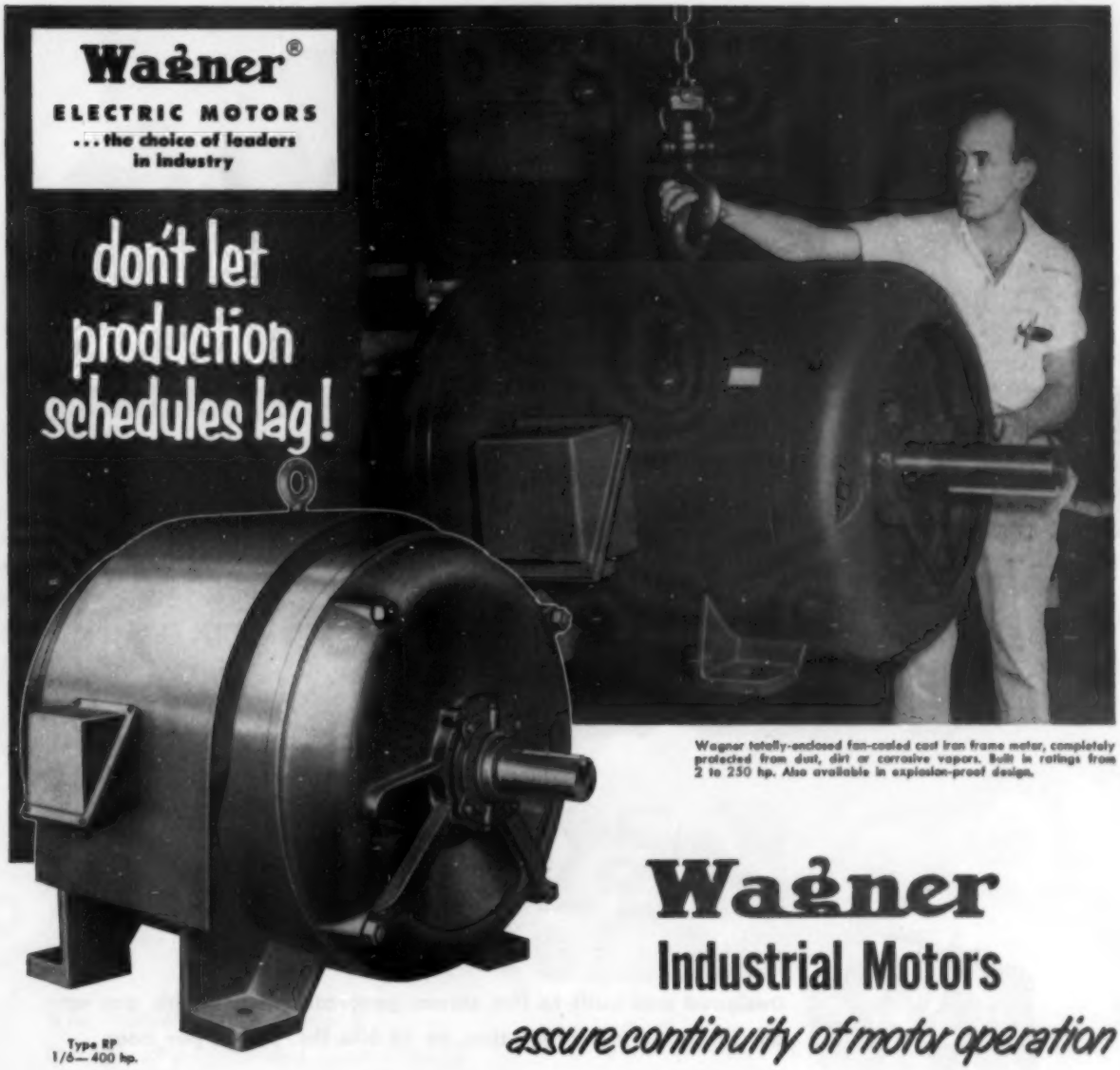
construction. All constructions are approved by Underwriters' Laboratories, Inc., and are recognized by the National Electrical Code, 1953. Single conductor cable is approved as Type UF (Underground Feeder), and the two and three conductor constructions are approved as both Type UF and Type NMC (Non-metallic Sheathed Cable—Corrosive Resistant). Multiple conductor FlexAll also is suitable for interior wiring, either exposed or concealed.

Unit functions as interrupter and disconnecting switch

C43 Load interrupter switch (Type VLB) for line sectionalizing and load switching is available from Westinghouse Electric Corp. It combines the functions of circuit interrupter and disconnecting switch and will interrupt transformer magnetizing currents, line charging currents, and load currents up to the continuous rating of the switch. The switch is available in voltages from 7.5 to 115 kv, with a continuous current rating of 400 and 600 amp.

Wagner®
ELECTRIC MOTORS
...the choice of leaders in industry

don't let production schedules lag!



Wagner totally-enclosed fan-cooled cast iron frame motor, completely protected from dust, dirt or corrosive vapors. Built in ratings from 2 to 250 hp. Also available in explosion-proof design.

Type RP
1/6—400 hp.

Wagner Industrial Motors

assure continuity of motor operation

The Wagner line of general-purpose polyphase squirrel-cage motors, built for rugged industrial service, includes a "family" of open protected-type ratings through 400 horsepower. These motors are protected by a heavy steel frame, with ventilating openings at the bottom only, and by endplates of drip-proof design.

These Wagner Motors have the winding strength and the adequate ventilation required to stand the shock of starting heavy loads repeatedly and to operate continuously without exceeding their rated 40° C temperature rise.

* * *

A skilled Wagner engineer will be glad to help you select the correct motor for *your* specific application. Just call the nearest of our 32 branch offices, or write for Bulletin MU-185 for complete information.

Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6429 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

M54-9

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NOW

. . . the most compact, *complete* burner in the industry for *fully automatic operation!*

the PEABODY PK-54

Designed and built to fire steam generating units with gas or oil, singly or in combination, to 42,000 lbs. steam per hour . . .

The result of years of research engineering and combustion experience, the modern Peabody PK-54 Burner is the most compact, complete and flexible burner for automatic operation in the industry. Extremely adaptable, the PK-54 is furnished with a factory-packaged control cabinet which can be mounted as an integral part of the unit or remotely located, depending upon job requirements. A fuel oil pump and heater set can also be included if desired. This modern burner features a new and proven air handling arrangement that assures operation with minimum excess air and maximum efficiency over an extended operating range. Wide range steam or mechanical atomizing, utilizing Peabody's constant differential principle of operation is used for oil firing. Continuous combustion and safety controls, for both gas and oil, are only a few of the many unique features built into this, the newest of a long line of burners known for efficiency for more than a quarter of a century.

Nameplate of Efficiency

PEABODY ENGINEERING CORPORATION

580 FIFTH AVENUE, NEW YORK 36, N. Y.

The Peabody PK-54 operates throughout an extended burner range and recycles without operator assistance in case of an operational shut-down. Each unit includes burner and blower, as well as an entire system of combustion, safety, and sequential controls—all of which are integrated by a modern design that's been tested and proved to be safe, outstandingly efficient and extremely adaptable.

Write TODAY FOR YOUR FREE COPY OF BULLETIN 430

PEABODY
ENGINEERING CORPORATION

Gentlemen:
Please send me Bulletin 430 giving details and specifications on the Peabody PK-54 Burner.

Name..... Title.....
Firm.....
Address.....
City..... Zone..... State.....

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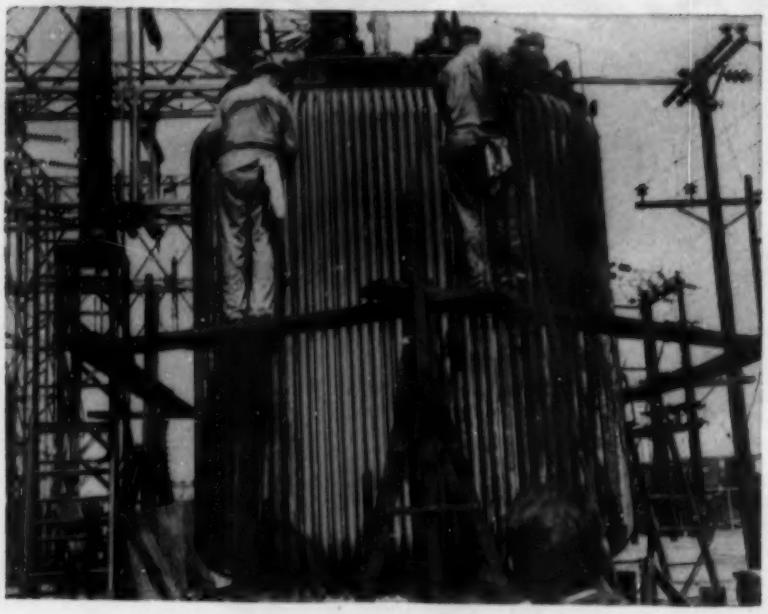
SUBOX guards all three! { STRUCTURES EQUIPMENT FENCES

with maximum protection and minimum application



• Subox paints assure both good radiation and excellent protection for transformers and sub-station equipment. They are easily applied by brush, spray or flow-coating. Use them on your present equipment—specify them on your present equipment—specify them on your new.

• All varieties of Subox and Subalox can now be supplied with a faster-drying vehicle for distribution transformers and other shop work.

• Sub-station structures can often be painted with a single coat and a minimum of outages.

• Industrial-type fences can be amply protected with one coat applied by floor brooms.

For simplified low-cost upkeep, write for free pamphlet "Electric Light & Power Maintenance".

Subox Inc.

9 Fairmont Plant

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letters

. . . from readers

Success With Stainless Steel

Gentlemen:

It is poor taste to condemn an organization, race, or church because a few of its members are unsatisfactory. It is, in the same token, poor practice to condemn stainless steels as a material for shaft sleeves because a few of the stainless steels have proved to be unsatisfactory for such use. In particular, Type No. 416 has proved to be poor with graphite lubricated packings because of the elements added to give it a free machining quality. Stainless steel covers a broad classification of alloys, therefore, selection of the type to be used must be made carefully.

We have in operation over a hundred pumps of various sizes, in addition to hydraulic turbines. We have had a great deal of success in spray metallizing shafts and shaft sleeves with stainless steel. Again the type used is as important as the technique of application. Our needs have been met using a high carbon, high chrome stainless steel. In some cases an intermediate self-bonding molybdenum wire improves bonding of stainless steel to the parent metal. Since each company's needs vary, experience alone is the deciding factor, but an open mind to all methods of solving sleeve maintenance problems must be held. Mr. Fisher's criticism of Mr. Karassik's article ("Letters," Jan. 54) must, therefore, be taken as "one man's opinion."

I would like to take this opportunity to compliment INDUSTRY AND POWER for consistently publishing articles of current interest. The January issue in particular was very informative.

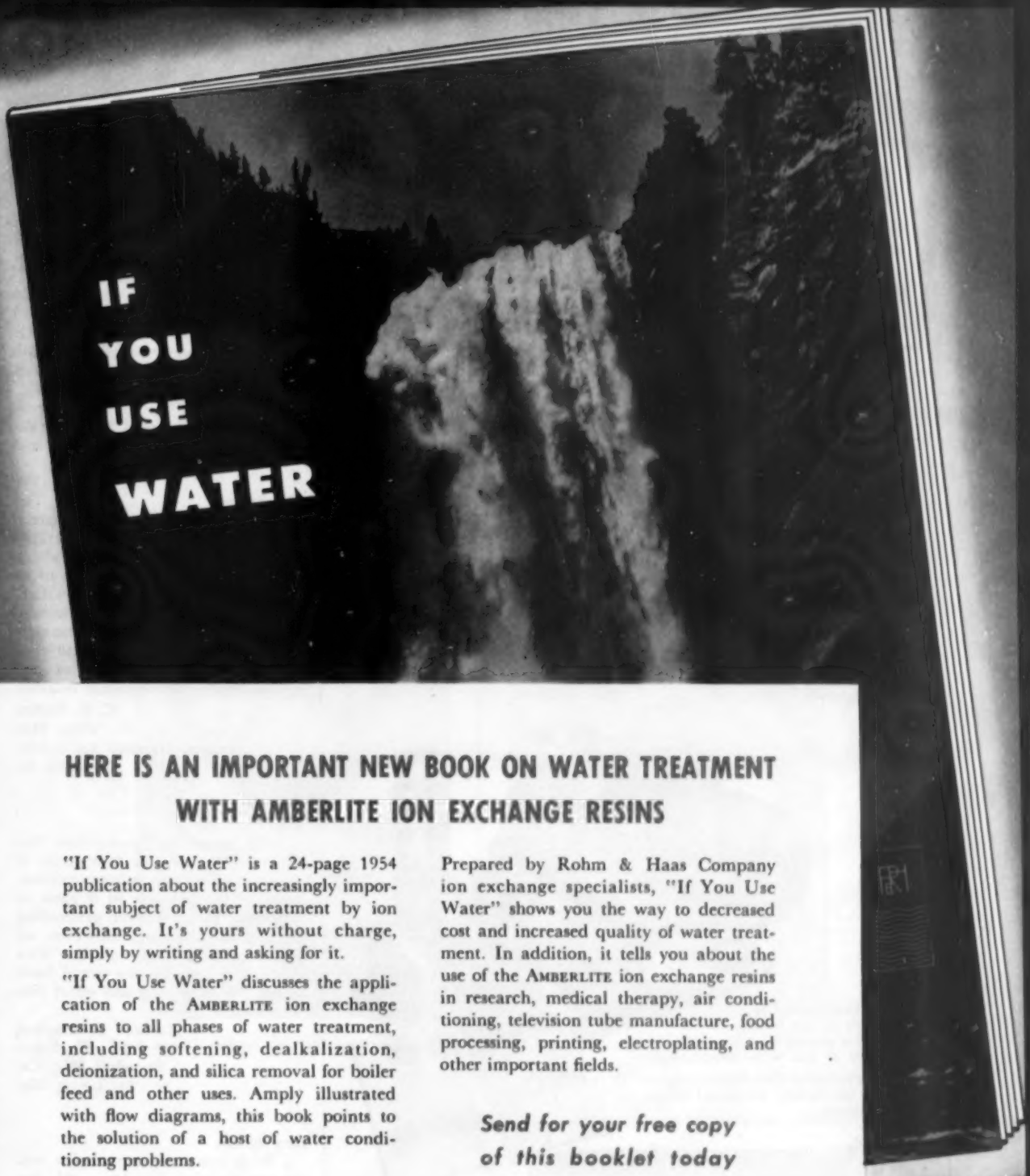
R. D. Neyer
Lancaster, Pa.

January Issue

Gentlemen:

You are to be complimented on your Industrial Development Review. It is just the sort of thing the average engineer needs to keep him conversant in the many now specialized fields of engineering that he does not normally come in contact with in his own particular job.

Have you considered having these



HERE IS AN IMPORTANT NEW BOOK ON WATER TREATMENT WITH AMBERLITE ION EXCHANGE RESINS

"If You Use Water" is a 24-page 1954 publication about the increasingly important subject of water treatment by ion exchange. It's yours without charge, simply by writing and asking for it.

"If You Use Water" discusses the application of the AMBERLITE ion exchange resins to all phases of water treatment, including softening, dealkalization, deionization, and silica removal for boiler feed and other uses. Amply illustrated with flow diagrams, this book points to the solution of a host of water conditioning problems.

Prepared by Rohm & Haas Company ion exchange specialists, "If You Use Water" shows you the way to decreased cost and increased quality of water treatment. In addition, it tells you about the use of the AMBERLITE ion exchange resins in research, medical therapy, air conditioning, television tube manufacture, food processing, printing, electroplating, and other important fields.

Send for your free copy of this booklet today

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

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AMBERLITE is a trademark, Reg. U.S. Pat. Off. and in other principal countries of the Western Hemisphere.

ROHM & HAAS COMPANY, Dept. IP1
Washington Square, Philadelphia 5, Pa.
Please send my copy of "If You Use Water . . ."

Name_____

Title_____

Firm Name_____

Address_____

City_____ Zone____ State____

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YOU'RE ALWAYS SURE of GREATER ECONOMY... with PREFERRED UNIT STEAM GENERATORS

With a Preferred "Packaged" heating unit you can be sure of—

1. A boiler designed for better performance, built beyond the codes, installed at lower cost.
2. A 25-year investment that pays for itself in one-fifth of its service life through more efficient steam production and greater fuel economy.
3. These Preferred quality features that make all the difference—

- Five Square Feet of Heating Surface per Boiler HP.
- Four-Pass Gas Travel.
- Anti-Stress Deck.
- Intermediate Furnace Position.
- Staggered Tubes.
- Down-Draft Design.
- Induced Draft.
- Expansile Precipitator.
- Dual Purging Action.
- Full Automatic Oil and/or Gas Burners.

Preferred Unit Steam Generators are available in sizes from 20 to 600 B.H.P. and pressures from 15 to 250 psi, to burn oil or gas or in combination.

All Preferred Unit Steam Generators are factory fire-tested before shipment.

GET THE COMPLETE STORY WRITE FOR BULLETIN 2000

PREFERRED UTILITIES MFG. CORP., 1860 Broadway, New York 23, N. Y.
Dept. SP-2

☐ Please send me Bulletin No. 2000

Name_____

Position_____

Address_____

City_____ Zone_____ State_____

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letters

—Starts on page 32

annual summaries prepared by men in industry (suppliers, sales engineers, directors of development, plant managers, contractors, etc.) who are up-to-date specialists in one or two particular fields? Each article should follow the same pattern or outline.

George Burnet
Commercial Solvents Co.
Terre Haute, Ind.

Gentlemen:

This type of feature (Industrial Development Review) should certainly be repeated in the years to come for the benefit of those of us who welcome just such "refresher" courses as this review offers, as well as adding digest impetus to the selling job sometimes required to convince superiors new theories and equipment are economically feasible.

C. E. Nutter
Ch. Mtce. Man
Argonne National Lab., AEC
Lemont, Ill.

Dear Sir:

Your Industrial Development Review gave us the key to a series of meetings of our operating personnel. Some of the subjects in it gave us assurance that we were proceeding on modern thinking. However on other subjects, particularly "Fire Protection," we felt we would have to put more thinking and effort into practice.

Edward R. Magnus
Ch. Engr.
Snowhill Mfg. Co.
St. Louis, Mo.

Gentlemen:

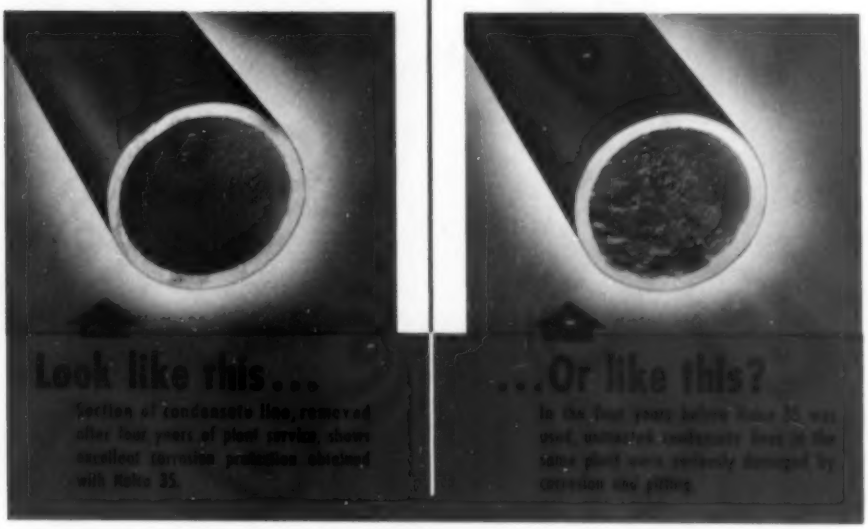
I think you have compiled a real service to your readers and the plant information included (in the January issue) should be carried on as an annual presentation. I find it of considerable value in showing the trend of the times.

INDUSTRY AND POWER is looked to each month with considerable interest and the articles are many times most helpful.

Paul R. Duffey
Ch. Pwr. Engr.
Youngstown Sheet & Tube Co.
Youngstown, Ohio

In the next 4 years...

Will your condensate return lines



See next page for data on how to keep your condensate return lines clean and corrosion-free . . . permanently.

THE Nalco SYSTEM...
SERVING INDUSTRY THROUGH PRACTICAL APPLIED SCIENCE

NATIONAL ALUMINATE CORPORATION
6216 W. 66th Place, Chicago 38, Ill.

Send me:

- ☐ Bulletin 35 . . . "Stop Condensate Corrosion in Return Lines, Tanks and Heaters."
- ☐ Reprint 29 . . . "Use of Amines in Low Make-Up Steam Plant."
- ☐ Reprint 30 . . . "Amines for Corrosion Prevention in Steam Condensate Systems."

NAME _____

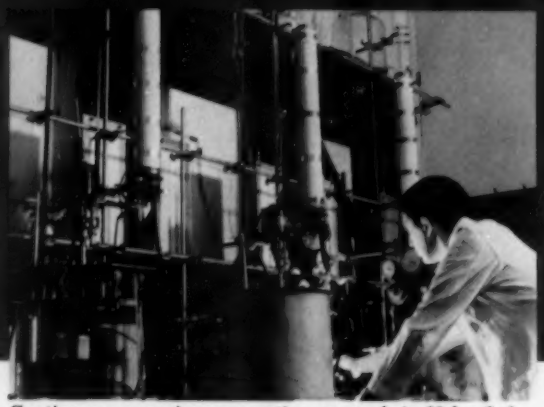
TITLE _____

COMPANY _____

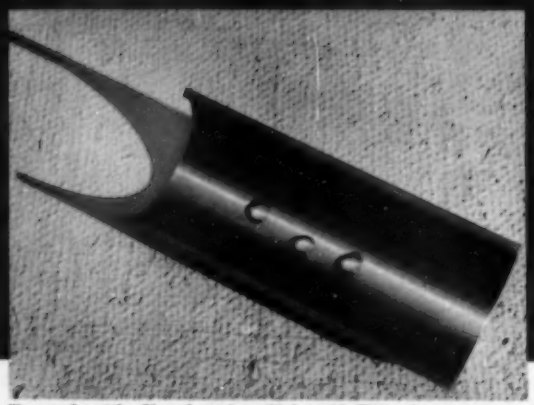
ADDRESS _____

CITY _____ ZONE _____ STATE _____

TWO *Nalco* METHODS FOR POSITIVE CONDENSATE CORROSION PREVENTION



Continuous corrosion-prevention research in Nalco Laboratories has developed outstanding control methods and chemicals for many types of corrosion problems.



Treated with film-forming Nalco 35-FM, this section of condensate pipe shows complete repellence to water droplets. Corrosive condensate never touches metal.

Nalco 35 PREVENTS CORROSION BY pH CONTROL

Nalco 35 controls pH in the condensate return system . . . neutralizes carbon dioxide to assure corrosion prevention. Especially recommended for low make-up systems, Nalco 35 vaporizes and condenses with the steam, *and at the same rate*. Uniform treatment concentration is assured throughout the system; and long-lasting Nalco 35 makes positive return-line, tank, and valve protection a real operating economy.

Nalco 35 FM PREVENTS CORROSION BY PROTECTIVE FILM

Nalco 35 FM protects metals in steam systems by forming a tough, rustproof microscopic film on all exposed surfaces. Corrosive gases and liquids cannot reach the metal surface to cause damage.

Nalco 35 FM is fed with a low-cost Nalco condenser-feeder, or any good chemical pump, directly into steam or condensate lines. Once your steam system has protection of Nalco 35 FM film, low dosages maintain film permanently.

Nalco WATER TECHS

Use the postpaid return card to get your copies of up-to-the-minute literature on condensate corrosion control listed on the reverse side of the card.

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PERMIT No. 3623
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6216 West 66th Place
Chicago 38, Illinois

new bulletins

. . . catalogs from leading manufacturers

200—Thermocouples

Valuable as a reference manual, 36-page bulletin 235-5 is a new edition of "Thermocouples and Accessories." Listed, with specifications, are standard thermocouples for all applicable temperature ranges. Separate sections are devoted to the tubular-type (Pyod and Baby Pyod) iron-constantan couples, wire-type iron-constantan and copper-constantan couples, and Chromel-Alumel alloy and platinum couples. Dimensional drawings of complete assemblies and installation diagrams are given. In addition to complete parts lists for each type, there are cataloged sections devoted to couple supplies and accessories. The Foxboro Co.

201—Distribution Regulators

Twelve-page bulletin 21B7977 describes the external and internal features of distribution regulators (Type JFR). Design and construction details of the latest Quick-Break tap-changing mechanism, improved Feather-Touch control, and unit construction are pictorially displayed and discussed. Listed in the bulletin are standard accessories and specifications for the regulator which is now available in ratings of 2500 v, 100 and 200 amp; 5000 v, 50 and 100 amp; 7620 v, 15, 50, and 100 amp, and 14,400 v, 50 and 100 amp. Allis-Chalmers Manufacturing Co.

202—Application Ideas

Application ideas, installation tips, and suggested circuits for utilizing the Detect-A-Flo unit, a device that controls or detects both liquid level and air flow, are presented in a 16-page illustrated booklet. Also given are detailed specifications, including response curves, on the performance, operation, and electrical characteristics of the unit under various conditions of use. Fenwal Inc.

203—Switchboard Instruments

Bulletin GEC-218C, 24 pages, gives a description of this company's AB-DB-18 and AB-DB-16 long-scale switchboard instrument lines as well as principles of operation, characteristics, and specifications. Prices and dimensions also are provided. General Electric Co.

204—Resin Coatings

"Bakelite Resin Coatings for General Industry," eight pages, reports on decreased maintenance costs, extended service life, and other advantages these protective coatings are said to afford the construction, petroleum, chemical, food, and transportation industries. Photographs illustrate actual case histories of coatings based on Bakelite resins in applications ranging from grain elevators, oil pipes, railroad hopper cars, and mining timbers to dairy processing equipment. Bakelite Company Div. of Union Carbide and Carbon Corp.

205—Relief Valves

"Your Handbook on Temperature and Pressure Relief Valves," is a 15-page pocket-size booklet which explains and illustrates the function of relief valves for industrial water heaters. It points out American Gas Association and ASME code requirements and presents recommended requirements for various uses. It also lists 25 "do's" and "don'ts" for relief valve users. A. W. Cash Valve Mfg. Co.

206—Air Heaters

This six-page bulletin describes in both print and detailed flow diagrams, operation of this company's air heater. It presents, in general terms, the wide scope of application for the direct-fired air heater. Peabody Engineering Corp.

207—Industrial Television

Putting television to work in the plant, bulletin WG-1813 describes equipment necessary for televising boiler water level gages. Equipment includes TV camera, illuminator, monitor, and necessary accessories. Yarnall-Waring Co.

208—Hydraulic Components

To simplify planning of hydraulic circuits and ordering of hydraulic components, a set of nine catalogs on this company's components line has been prepared. Designed to eliminate time-consuming cross-references, each page includes all the basic data needed for an individual product. Each catalog also features a visual index showing a photo of the product and the page where specifications are to be found. Large cutaway views show construction features and clearly identify parts for ordering replacements. The nine catalogs are: 601—pumps, motors and power units; 701—150 psi air or 300 psi oil hydraulic cylinders; 721—2000 psi cylinders; 741—3000 psi cylinders; 801—2000 psi valves, threaded connections; 821—3000 psi valves, flange connections; 841—3000 psi valves with gasket mountings; 901—accessories such as filters, gages, pressure switches, weld-type flanges, heat exchangers, slip joints; 1001—Engineering Manual. Hydraulic Power Division, The Hydraulic Press Mfg. Co.

209—Keyways

Have you ever wished that you could cut your own keyways by hand, quickly, at low cost? This four-page folder lists broaches and kits that will enable you to cut any size keyway in 60 sec or less. A list of sizes and prices is included. The du Mont Corp.

210—Vacuum Cleaning

Permanently installed vacuum cleaning systems for industrial use are described in 11-page bulletin A-930. Basic elements of the system are shown in cross section. Coordinated accessories and auxiliary equipment are pictured. U. S. Hoffman Machinery Corp.

211—Boiler-Burner Unit

The boiler-burner unit described in 16-page bulletin 1031 is pre-engineered and said to be completely integrated for balanced performance. A two-page spread shows a cross-section of the unit in full color. Each component of the system is labeled and fully explained in the text. Shown are oil, gas, or combination units that will burn either gas or oil. Ray Oil Burner Co., Kewanee-Ross Corp.

212—Combustion Control

A boiler plant designed for efficiency, future expansion, maximum fuel flexibility, fine appearance, and "good neighbor" performance is described in this detailed "Result Story," bulletin R-9 of A. B. Dick's new $6 million installation in Niles, Illinois. Frank M. Donner, Chief Power Engineer at A. B. Dick, points out how this boiler plant and Hays combustion control enables them to switch fuels easily to obtain high efficiency. The Hays Corp.

213—Filters

Staynew automatic filters designed for large air volume and high efficiency are described in 12-page bulletin 500. Specifications, engineering, and performance data covering automatic filters in a wide range of sizes for handling any desired air capacity are given. Dollinger Corp.

214—Steam Traps

Steam traps which vent air from steam units eight times faster than ordinary inverted bucket traps are described in four-page folder 1153. Complete buying information on these Super-Silvertop Heat-Kwik traps includes condensate capacities, sizes, weights, and prices. A short description of other products manufactured by the Steam Specialties Div. of this company is also given. V. D. Anderson Co.

215—Couplings

Flexible couplings which never require lubrication are shown in 19-page bulletin 1009. Valuable engineering data for each type of coupling are given in table form along with drawings and application recommendations. Two more tables give conversion data for varying or pulsating load and for horsepower to torque. Lovejoy Flexible Coupling Co.

216—Dust Collector

Model "R" Aeroturn dust collector is described in this four-page folder as the first major advancement in dust collector design since the introduction of Hersey type reverse-air-jet filters. Advantages and operation of the units are explained. A cross-sectional drawing points out the special construction features. Turner & Haws Engineering Co., Inc.

217—Heat Exchange

Featured in the winter 1954 "Alco Products Review," is an article outlining the accomplishments of the heat-exchanger research program conducted since 1946 at the University of Delaware. Heat-transfer coefficients and pressure drop for various tube spacings and arrangements are discussed along with the effect of baffling on various flows. This section also includes a complete bibliography of papers on heat transfer and fluid flow. Other articles describe the jet-engine exhaust gas cooler installed at the new Naval Air Turbine

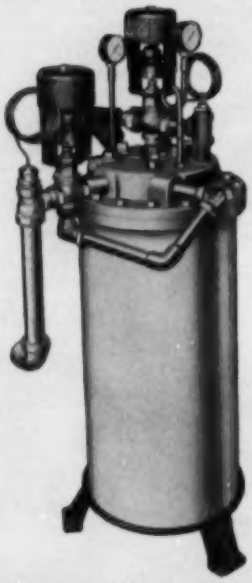
NOTE—Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 36/37 & 100/101.

CONDITIONS DEMANDED

So- COE DEVELOPED

The WATER HEATER OF TOMORROW

Here is a radically different water heater developed in response to a persistent demand. • It arrives completely assembled and tested. No accessories to buy and install. Simply attach a few pipes, then turn on steam and water. • Utilize abundant water at the safe temperature of 120° F. for washroom and showers. • And, if desired, you can pipe directly from the tank simultaneously for scalding water at 160° to 180° F. • Dependable regulators closely control temperatures. • Send the coupon for illustrated descriptive literature.



Heavily glass-lined A. S. M. E. tanks

Long life through minimum corrosion

MAXIMUM Thermal Efficiency

All parts quickly and easily accessible

A "PACKAGE" UNIT

Completely Insulated and Protected by Waterproof Cover

17 Sizes

Capacities 200 to 3600 G. P. H.

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502 BANK STREET • PAINESVILLE, OHIO

SEND US YOUR LITERATURE DESCRIBING
THE COE SAFETY WATER HEATER

Name _____
Company _____
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City _____ State _____

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new bulletins

—Starts on page 37

Test Station, Trenton, N. J., and casing head gas processing and storage at the Diamond M-Sharon Ridge gasoline plant. Public Relations Dept. of the American Locomotive Co.

Heaters

Horizontal and vertical heaters in steel, copper lined, copper-silicon, cement lined, clad and galvanized construction, as well as the low-flow design are each cataloged as to weights, dimensions, construction details, and capacities—with conversion tables, in 48-page catalog 18. Piping diagrams are given for high and low pressure steam systems. Also included is a step-by-step guide for setting up and connecting a storage heater. Listed also are average water requirements of typical hot water fixtures in various types of buildings. **Please send requests directly to The Patterson-Kelley Co., Inc., Dept. I & P, 388 Warren St., East Stroudsburg, Pa., on company letterhead.**

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pgs. 36/37 & 100/101. Your requests will be handled promptly.

218—Gages

Reputed to be the most comprehensive catalog ever produced on pressure gages, gage accessories, and gage engineering information, 125-page bulletin is supplemented by numerous photographs, line drawings, and dimensional drawings. It is sectionalized by product lines and includes a contents page, a numerical index, an alphabetical index, and selector tables for both the Ashcroft Duragauges and Ashcroft Quality Gauges. Manning, Maxwell & Moore, Inc.

219—Packaged Boilers

Powermaster packaged automatic boilers in seventeen sizes from 15 through 500 hp for steam process as well as steam and hot water heating service are described in a four-page folder. It lists the advantages of packaged automatic boilers contrasted with equipment of conventional design. The firing equipment for light and heavy oils as well as gas is described for this company's Vorifiow air-atomizing oil burner and pre-mix gas burner designs. Installation photographs emphasize various fuel firing arrangements. Orr & Sembower, Inc.

220—Space Heaters

Engineering brochure "Case Studies" describes a variety of successful applications of conventional warm air space heaters to the job of industrial process drying. Featuring installations for curing rubber, and drying ceramic, paper, lumber, and woven products, the studies explain the methods followed in applying the heaters to different drying systems. Dravo Corp.

Flexible Tubing

Scientific application of flexible tubing for air, oil, steam, gases, and volatiles is explained in eight-page data book "PENFLEX Flexineering." Products cataloged and pictured are steel, bronze, and aluminum tubing and hose in many types of construction; blower and ventilation hose; tar and asphalt hose; tank car hose; diesel

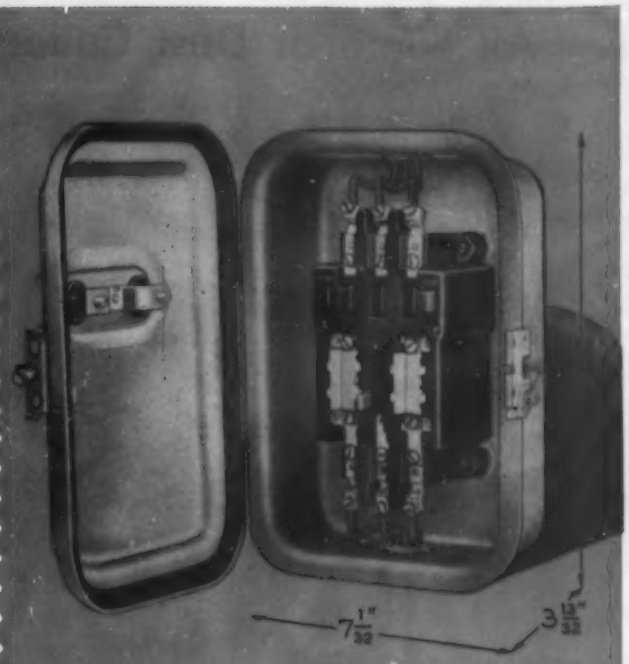
ALL NEW

and designed *specifically* for the

TEXTILE INDUSTRY

THE AH TYPE "LM"

LOOM SWITCH



SIZE 0 — 3 POLE — 2 HP To 600 VOLTS A-C

Here for the first time is a manual, across-the-line Starting Switch designed and built *specifically* for the Textile Industry. Completely new and radically different throughout, the Arrow-Hart Type "LM" employs a distinctive, built-for-the-purpose switch mechanism housed in a specially engineered, lint proof enclosure . . . It is *NOT* just an adaptation of a standard switch with a "face lifting." As a result the Type "LM" assures new standards of performance, dependability and safety on single or multiple spindle looms.

Outstanding Features..

- **UNIQUE ROTARY TYPE MECHANISM RESISTS SHOCK** . . . far in excess of any found in actual installations.
- **LINT PROOF ENCLOSURE** . . . with efficient, balloon type neoprene impression gasket. No knockouts or mounting holes to admit lint. Self-locking latches hold cover tightly even though screws aren't tightened.
- **MUCH SMALLER SIZE, GREATER COMPACTNESS** . . . saving valuable space.
- **FULLY ENCLOSED MECHANISM** . . . for extra safety, double protection against lint.
- **PUSH BUTTON OPERATION** . . . the *preferred* control throughout industry. Buttons are lint proof, electrically insulated.
- **STRAIGHT-THRU WIRING** . . . is faster, easier to install, no need for looping or U-bending.
- **SAFER RE-SET MECHANISM** . . . with lever *inside* lockable enclosure restricts re-starting to qualified personnel. Mechanical interlock prevents re-setting unless the Switch is "Off."
- **SWITCH EASILY REMOVED FROM ENCLOSURE** . . . without disturbing wiring. All wiring is brought to terminal blocks; switch is secured to these by 6 screws.
- **UNDERWRITERS' APPROVED FOR SINGLE AND GROUP FUSED INSTALLATIONS!**

SEND FOR COMPLETE INFORMATION . . . write for your copy of the new A-H Loom Switch Folder.

ON DISPLAY at the AMERICAN TEXTILE MACHINERY EXHIBITION Atlantic City, N.J. — April 26 thru May 1, 1954 Booths Nos. 868-869

INDUSTRIAL CONTROL DIVISION

The ARROW-HART & HEGEMAN ELECTRIC Co.

103 HAWTHORN STREET, HARTFORD 6, CONN.

Please send me my new Loom Switch Folder.

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CO. NAME _____

POSITION _____

ADDRESS _____

CITY _____ ZONE ____ STATE IP-3

A Complete Line of ADVANCED DESIGN Motor Controls for the Textile Industry.

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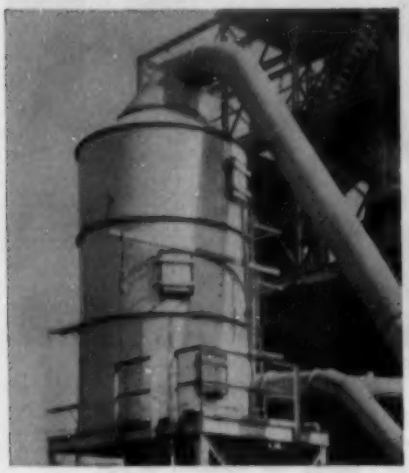
For All Fume or Dust Collection—

Norblo

brings you outstanding efficiency in three types of systems

Centrifugal



Hydraulic

Automatic Bag Type

WHATEVER your need for dust or fume control, Norblo builds rugged, efficient equipment in Centrifugal, Hydraulic and Bag type collecting systems. These three types, frequently used in certain combinations, provide economical dependable control as required in smelting, rock products, chemical, milling and processing fields.

Norblo Systems make outstanding records for high recovery with low operating and maintenance costs. Profit by Norblo's 30 years experience in heavy duty collection and Norblo development of these basic types of equipment. For good advice on dust or fume problems, consult Norblo.

The Northern Blower Company

Engineered Dust Collection Systems for All Industries

6422 Barberton Ave. OLympic 1-1300 Cleveland 3, Ohio

Circle 526 on Reply Card for more data

new bulletins

—*Starts on page 37*

piping; marine unloading hose; electric conduit; rivet passers; and barrel fillers. **Please send requests directly to PENFLEX, Dept. IP, 72nd St. & Power Ln., Phila. 42, Pa. on your company letterhead.**

221—Insulation

Mono-Kover, lightweight one-piece pipe insulation is the topic of this four-page bulletin. Description of the ease with which the insulation may be applied is accompanied by photographic illustrations. Added features are a chart indicating thermal efficiency of Mono-Kover, a suggested specification form, an insulation thickness selection table for insulation surface temperatures, and a table showing available sizes, thicknesses, and packaging data. Baldwin-Hill Co.

222—Sump Pumps

Construction details, head and capacity tables, dimensions, and other data are contained in bulletin 1029 titled "Johnston Unit-Line Sump Pumps." As described in the booklet, Unit-Line Sump Pump is a pre-engineered packaged line from which a pump can be selected for existing conditions or for new construction. Johnston Pump Company.

223—Valve Maintenance

"Getting The Most Out of Your Valves," seven-pages, covers the selection of valve types and materials, installation and operation, as well as inspection and maintenance pointers. Cooper Alloy Foundry Co.

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224—Materials Handling

Three reference folders are offered by this company: A-152 on screw conveyors and accessories; A-1152 on multi V-belt sheaves; A-853 on roller chain sprockets. Each bulletin points out advantages of construction and shows cross-sections. Fort Worth Steel and Machinery Co.

Belt Splicing

Rubber transmission belt splicing is explained by means of pictures and text in 32-page handbook S-35. It lists tools and material required, illustrates the procedure for stepping down belt ends, cementing and applying tie-gum, assembling fill-in material, and vulcanizing the splice. Tables are included for figuring endless belt lengths and time required for vulcanizing. **Please send requests directly to B. F. Goodrich Co., Dept. IP, Akron, Ohio, on your company letterhead.**

225—Electric Heating

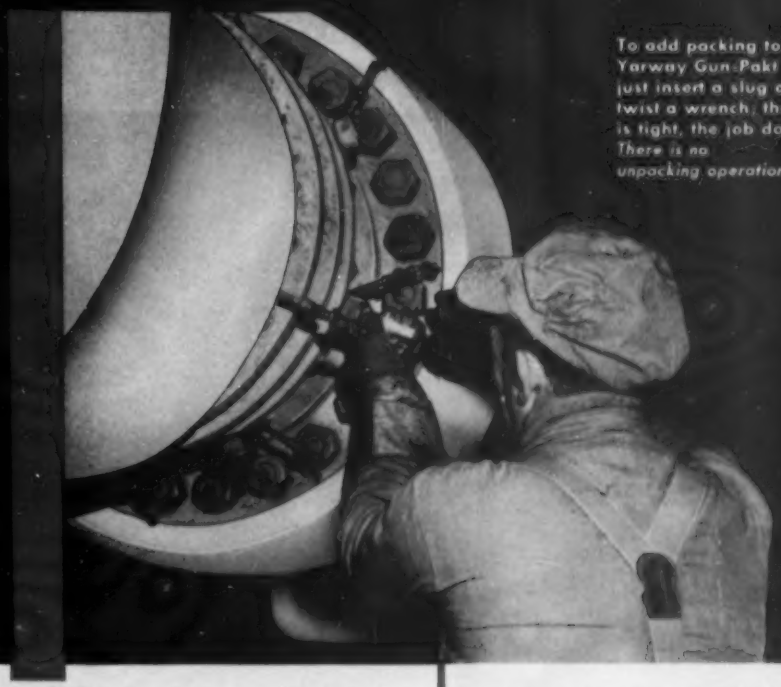
Industrial electric heating applications and methods are described in 32-page booklet, "101 Ways to Apply Electric Heat." Illustrated case histories show experience-tested ways to apply metal-sheathed Chromalox electric heating units in various industrial jobs. Physical aspects of installation are shown along with a description of the problem, solution, and advantages obtained. A section is devoted to far-infrared heating, showing 28 typical uses. Edwin L. Wiegand Co.

—*Continued on page 102*

Circle 527 on Reply Card for more data

STARTLING NEW FACTS ON EXPANSION JOINT MAINTENANCE

It may cost less than you think to service expansion joints. Look at these records from three typical users of Yarway Gun-Pakt Expansion Joints:



To add packing to a Yarway Gun-Pakt joint, just insert a slug and twist a wrench; the joint is tight, the job done. There is no unpacking operation.

	YARWAY GUN-PAKT JOINTS	CONVENTIONAL GLAND-PACKED JOINTS
STATE UNIVERSITY*	Required addition of only 3 slugs (45 cents) of packing in 5 years. Lubrication only once every 6 months. Total labor time of only 2 manhours in 5 years.	Same lubrication as Gun-Pakt, *plus* gland tightening, *plus* complete overhaul with shutdown for unpacking and repacking every 3 to 4 years. Time for overhaul—25 manhours per joint!
MID-WEST AIRFIELD*	Only maintenance was lubrication and addition of 2 slugs (30 cents) of packing per year. Total labor ¼ manhour per joint per year.	Lubrication and gland tightening required 8 manhours per joint per year—plus complete unpacking and overhaul every 2 to 3 years. Time required for overhaul—20 manhours per joint.
"BIG TEN" UNIVERSITY*	Lubrication only once every 2 months, with packing added as needed. Total labor time charged, 1 manhour per joint per year.	General maintenance requires 6 manhours per joint per year. Complete overhaul required every 2 to 3 years with unpacking and repacking—24 manhours per joint.

*Names on request.

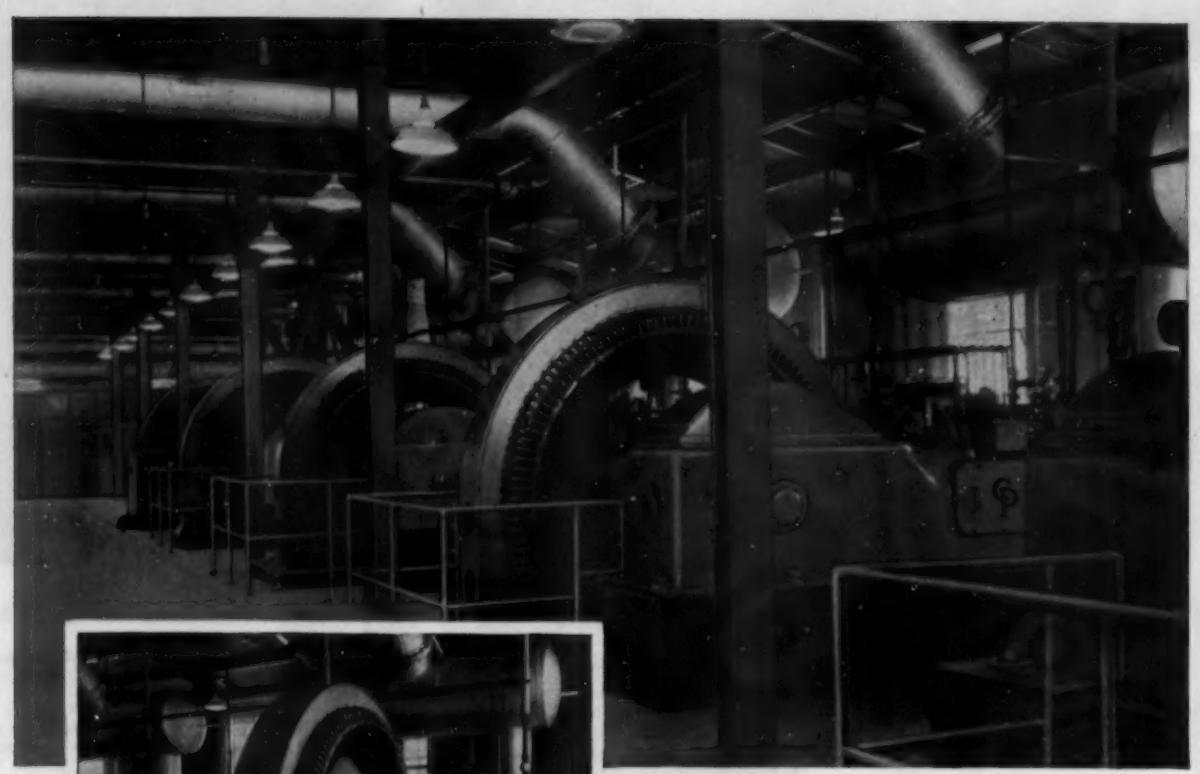
To get the full facts on Yarway Gun-Pakt Expansion Joints, and how they can save you maintenance money, write for Yarway Bulletin EJ-1913.

YARNALL-WARING COMPANY
109 Mermaid Ave., Philadelphia 18, Pa.

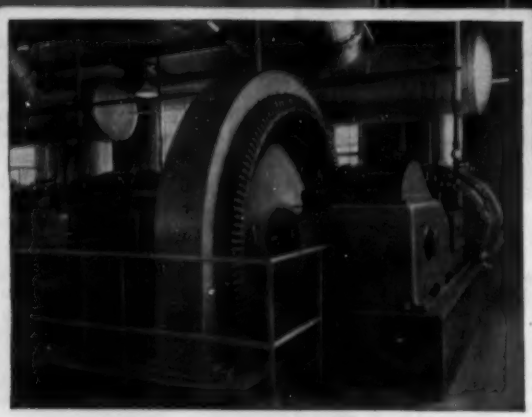
YARWAY

Yarway single-end, welding type Gun-Pakt joint for pressures to 300 psi, heavier design for higher pressures. Single-end traverses up to 12 inches; double-end up to 24 inches.

gun-pakt expansion joints



Five 1,000 hp Class O-DE compressors installed in a chemical plant.



CP COMPRESSORS

ON TAP 24 HOURS A DAY!

Chicago Pneumatic's heavy duty, Class O Compressors are a prime favorite where 24 hours-a-day service is required.

Engineered for continuous, heavy-duty usage, the Class O affords complete dependability with low operating cost. And they require minimum attention and upkeep. Built in sizes up to 2,000 hp, they're available in single and multi-stage designs, steam and electric drives, for a wide range of pressures. For more information write for Bulletin 726. *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, New York.*

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

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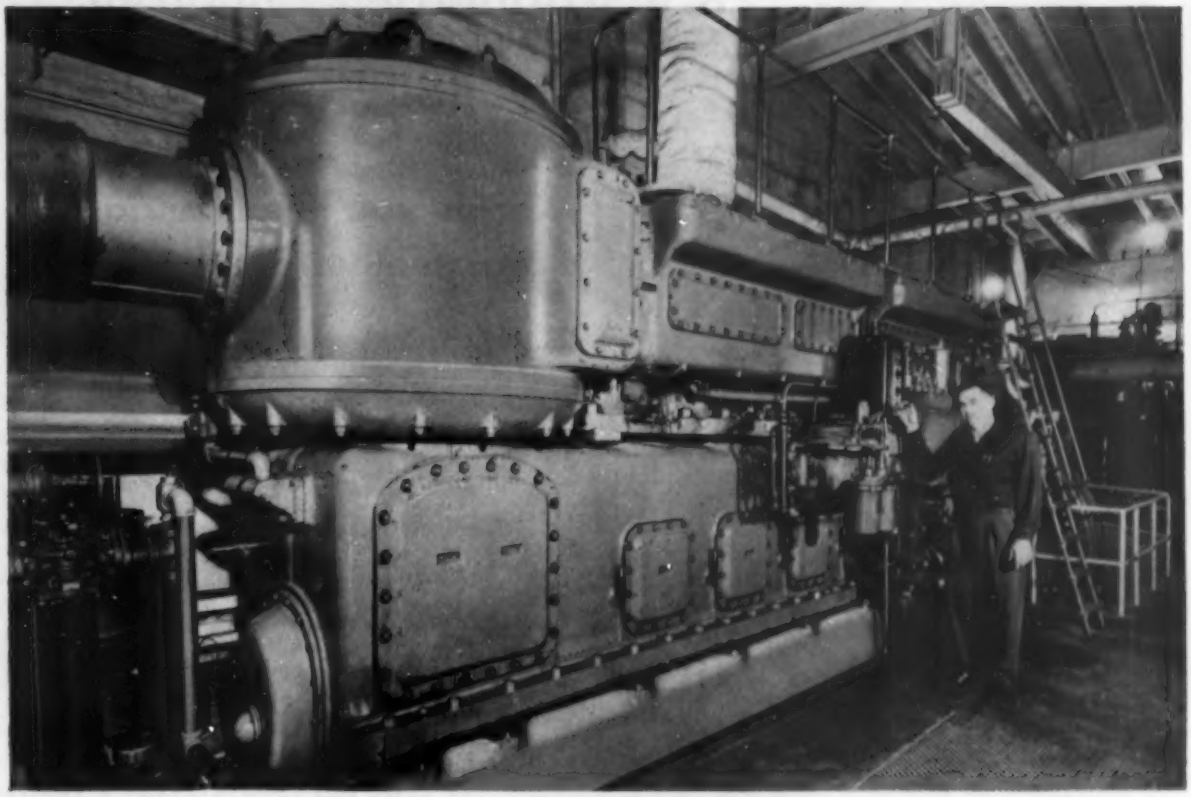
"Our tests show Gascon® Oils best!"



. . . says A.E. Harms, CHIEF ENGINEER

YUKON MILL AND GRAIN COMPANY, YUKON, OKLAHOMA

It's *doubly* important that the Yukon Mill and Grain Company's 5 diesels operate with as little trouble as possible. For this plant not only supplies power for the mill, but also for the City of Yukon.

Chief Engineer Harms writes, "When we changed to Sinclair GASCON Oil D-HD, the results were extremely satisfying—wear has been greatly reduced, varnish is gone from pistons and cylinders and stuck rings are a thing of the past. As you might expect, we now use Sinclair exclusively."

You too, can rely on Sinclair's full line of top quality diesel lubricants. Phone your local Sinclair representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

save wear and replacements

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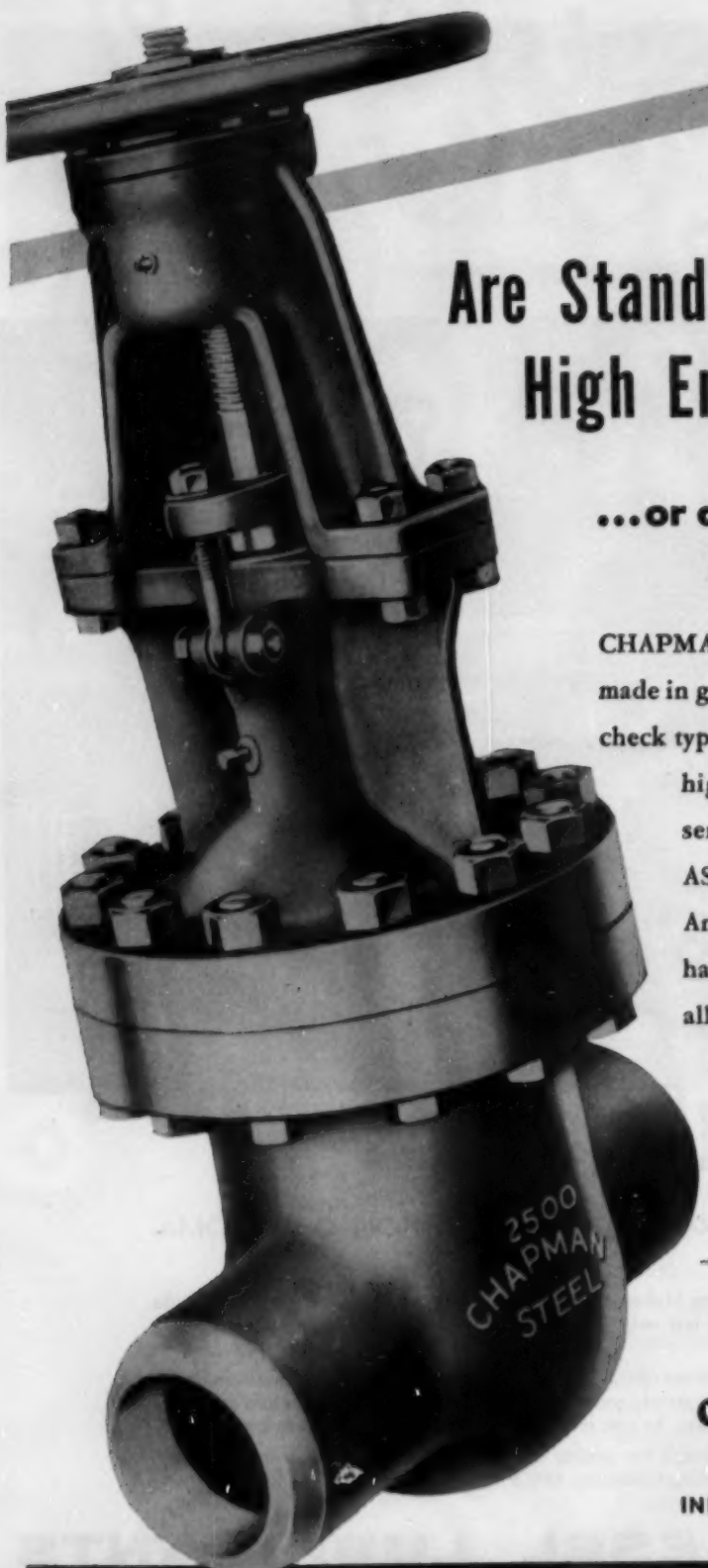

Are Standard Pressures High Enough For You

...or do you need *special* steel valves?

CHAPMAN CAST STEEL VALVES are made in gate, globe, swing and tilting disc check types . . . to handle the most severe high-pressure, high-temperature services. These valves are made to ASA and API ratings in all sizes. And on the special side, Chapman has everything needed to develop alloys and designs for *any* requirement. Do *you* have Catalog 20?

THE CHAPMAN VALVE MFG. CO.
INDIAN ORCHARD, MASSACHUSETTS

YEAR BY YEAR, CHAPMAN WRITES NEW CHAPTERS IN METALLURGY AND FLOW-CONTROL

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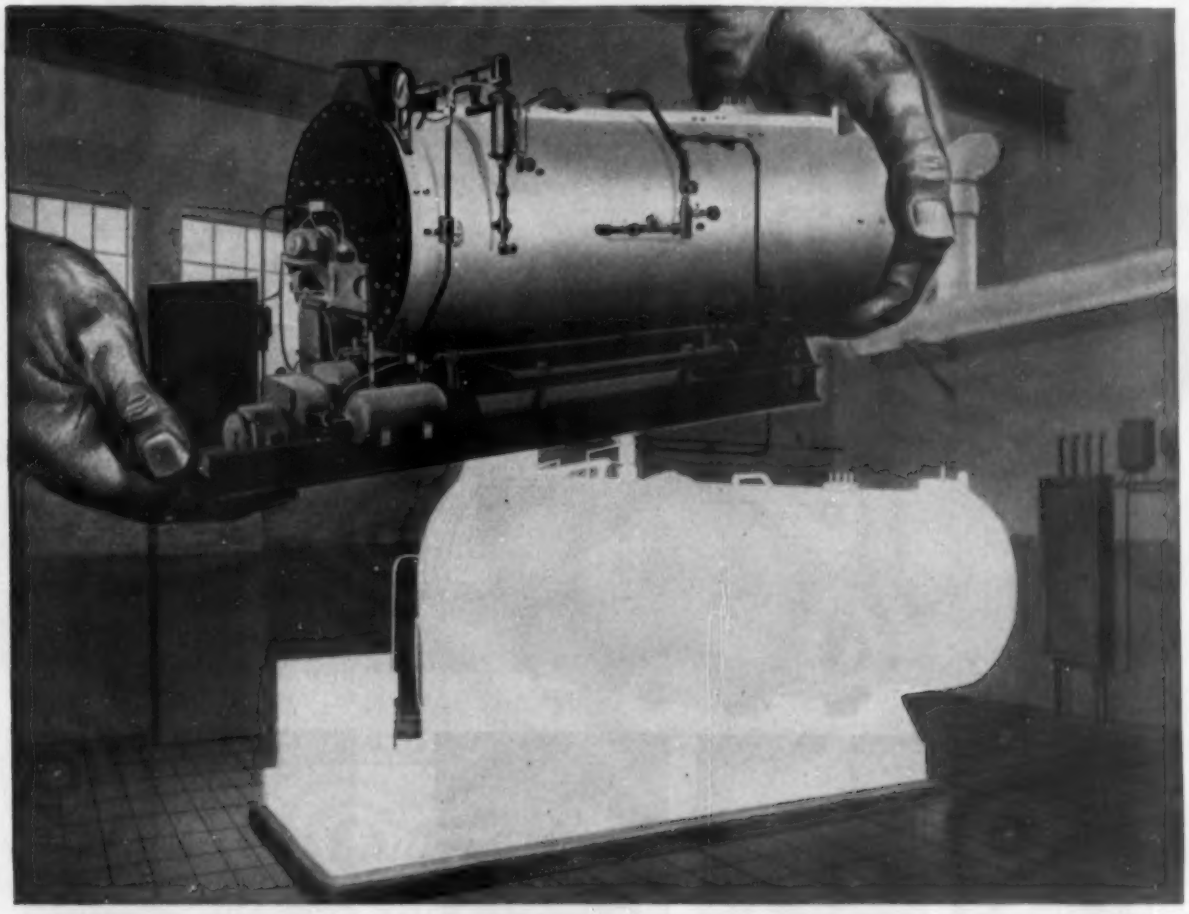
Here's why you get more...when you buy a Cleaver-Brooks Self-Contained Boiler



...only Cleaver-Brooks can offer you the experience gained from more than 20 years of pioneering . . . and more than 12,000 individual "packaged" boiler installations

CLEAVER-BROOKS pioneering has been largely responsible for simplifying boiler buying . . . lowering costs of installation . . . delivering 80% guaranteed steam efficiency from every fuel dollar.

Boilers can be shipped as completely assembled and tested self-contained units, with auxiliaries as required. Installation involves minimum of time, construction and space. Usually connections only to steam, fuel, water lines and electrical service are needed. No special foundations are required. A short vent takes care of exhaust gases. Frequently, boilers are ready for use in a matter of *hours*, depending on availability of service lines.

Cleaver-Brooks, originators of the self-contained boiler, offers wider experience that counts in another important way. Qualified engineers help you plan steam plants tailored *exactly* for your needs. Carefully analyzed are loads, space and equipment arrangement. This not only helps you solve present steam needs, but adds flexibility for future expansion as well.

This application engineering, plus basically sound design and construction is your assurance of a full return from your boiler investment. When you specify a self-contained boiler — make sure it's a Cleaver-Brooks.

Send for Catalog AD-100 for full details on Cleaver-Brooks boilers. Available for oil, gas and combination oil/gas firing. Sizes 15 to 500 hp, 15 to 250 psi — for heating and processing.

CLEAVER-BROOKS COMPANY
Dept. C 302 E. Keefe Ave.
Milwaukee 12, Wisconsin, U.S.A.

Cleaver-Brooks
ORIGINATORS OF
THE SELF-CONTAINED BOILER
Steam Boilers • Oil and Bitumin Tank
Car Heaters • Distillation Equipment
Oil and Gas Fired Conversion Burners

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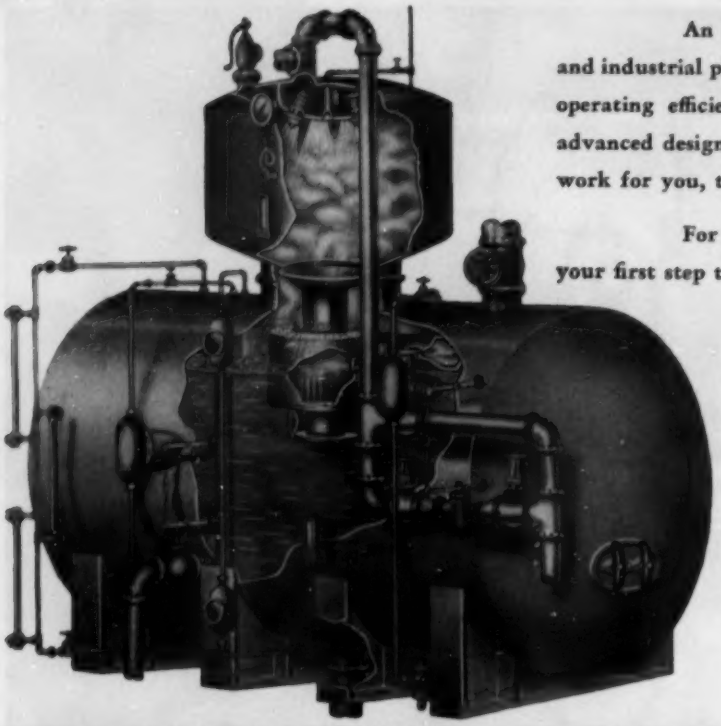
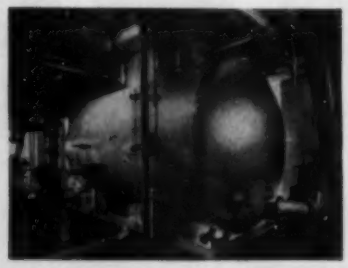
In Deaeration, too

BELCO Builds a Complete Line-



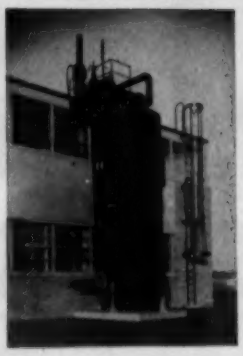
An increasing number of well known utility and industrial plants are using Belco equipment to increase operating efficiency and decrease operating costs. Belco advanced design and application experience can be put to work for you, too.

For technical assistance write or call Belco — your first step to lower costs.



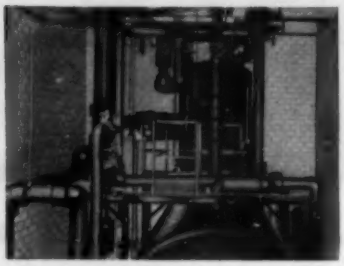
SPRAY TYPE — Belco Deaerator in large eastern oil refinery. Has a capacity of 300,000 lbs/hr.

MARINE TYPE—Typical Belco marine heater furnished to shipyards. (Approved by Lloyds of London)



OPEN TYPE—Deaerator at large eastern pharmaceutical plant. Capacity of 80,000 lbs/hr.

VACUUM TYPE — Unit shipped set-up to midwestern utility. Has 150,000 lbs/hr capacity.



SPRAY TRAY TYPE — Belco Deaerator at New York State institution boiler house. Capacity 120,000 lbs/hr.

TRAY TYPE — Belco Deaerator at southern municipality. Has a capacity of 125,000 lbs/hr.

Belco

Boiler Feedwater Heaters • *Water Softeners* • *Filters* • *Clarators*
Demineralizers • *Automatic Process Control Panels*

BELCO INDUSTRIAL EQUIPMENT DIVISION, INC.
114 PENNSYLVANIA AVENUE, PATERSON 3, N. J.

REGIONAL OFFICES: *Philadelphia, Pa., Chicago, Ill., Houston, Texas*
North Hollywood, Cal., Montreal, Que., Toronto, Ont.
Representatives in all principal cities of the United States and Canada

BELCO DESIGNS, ENGINEERS & FABRICATES WATER PROCESSING EQUIPMENT

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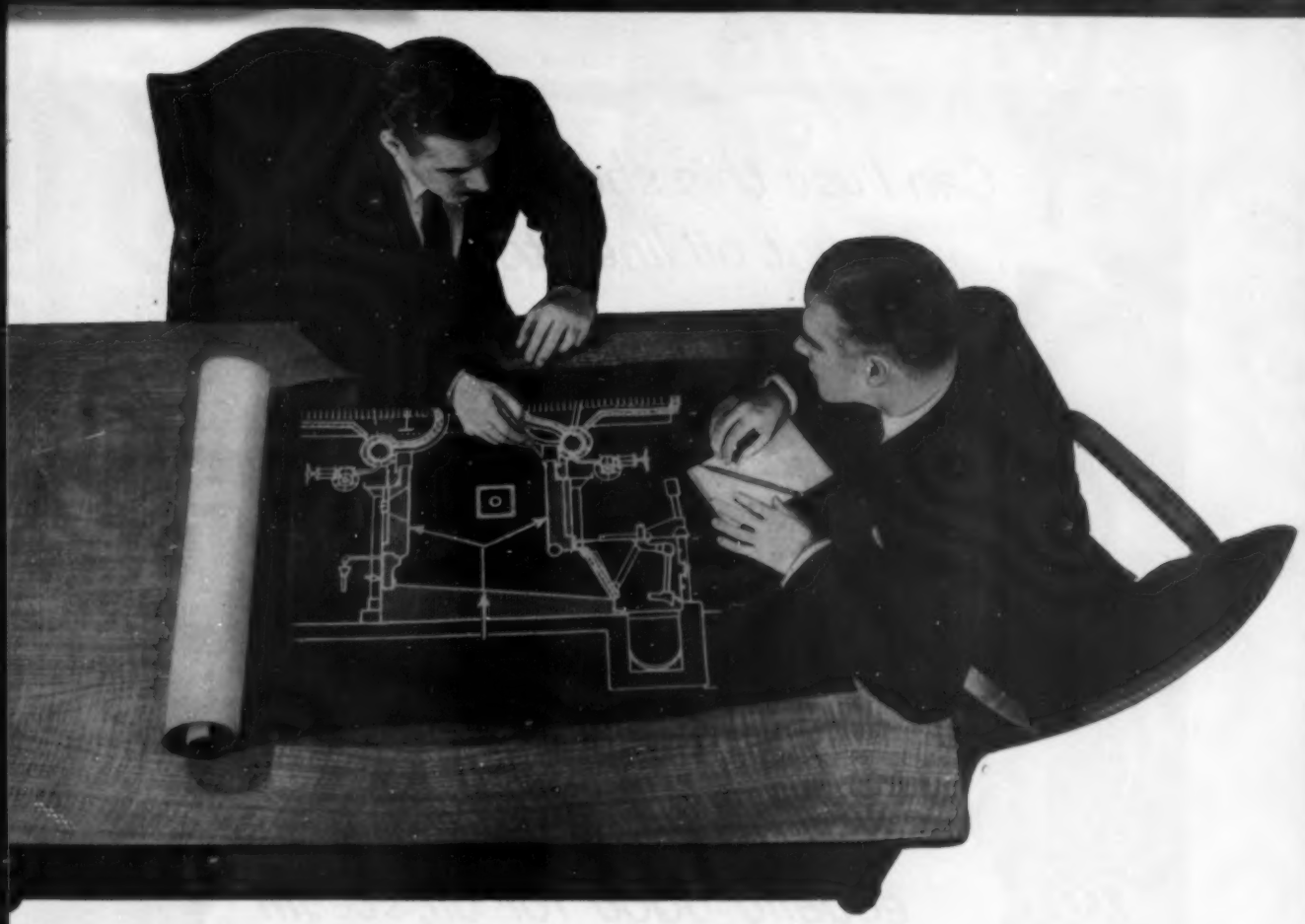

PROMINENT PUBLIC UTILITY

Cuts ashpit maintenance with B&W Refractory Concretes

A trial installation of B&W Refractory Castable "A", a 2600 degree refractory concrete, was made in one boiler ashpit. To date this castable has given 25 months more maintenance-free service than the refractories previously used.

Results of this first trial were so encouraging that another ashpit, shown in the drawing above, was lined with B&W Refractory Castable "A". In this installation the two opposing high velocity water sprays cut refractories life two ways. First, water splattered on the hot walls (about 1800F) caused spalling. Second, the high velocity water jets had an abrasive effect on the floor refractories.

Here's the report: "After 20½ months service, B&W's Castable "A" lining was still in excellent condition—far superior to the refractories used before."

On the basis of these trials three other boiler ashpits have been lined with this 2600 degree castable.

In addition to ashpit linings, B&W Refractory Castable "A" is widely used in boilers for baffles, hearths, door linings, special shapes, repairing eroded brickwork and forming pier walls in stoker-fired boilers.

B&W Castable "A" is only one of a line of B&W Refractory Concretes which cost-conscious furnace operators are putting to increasing use in hundreds of different applications. These B&W Concretes may help you cut installation costs and lengthen furnace life. Consult your B&W Field Engineer.

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R470A

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Your J-M Packings Distributor can tell you why this quality sheet packing has maintained such an excellent reputation for over 35 years

Where it's used: Every industrial plant can use J-M Service Sheet Packing to advantage. It's the favorite packing of thousands of plant engineers and maintenance men. Both versatile and dependable, Service Sheet makes a tight, long-lasting seal against superheated steam, air, gas, water, hot oil and ammonia, as well as many acids and chemicals.

What its advantages are: J-M Service Sheet is a quality packing, made of selected long-fibre asbestos bonded with heat-resisting compounds. It is graphited on one side to permit breaking a joint without destroying the gasket. The ungraphited side is ruled into one-inch squares to speed cutting and reduce waste. And . . . you can order it in large economical quantities because J-M Service Sheet will not dry out in stock!

How it is furnished: Service Sheet is supplied in sheets 54″ x 63″, 36″ x 126″, 36″ x 63″, and 54″ x 126″ sheets in thicknesses of 1/64″ to ¼″ and 108″ x 126″ sheets in thicknesses of 1/32″ to ¼″. It is also furnished as cut gaskets in standard and special shapes. See the J-M catalog for further details.

Your J-M Packings Distributor carries complete stocks of J-M Service Sheet and other quality Johns-Manville Packings. He can help you choose the right packing for your application. Write him for complete information and copy of folder PK-19A, "Thousands of Plants Rate It Tops." Or address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

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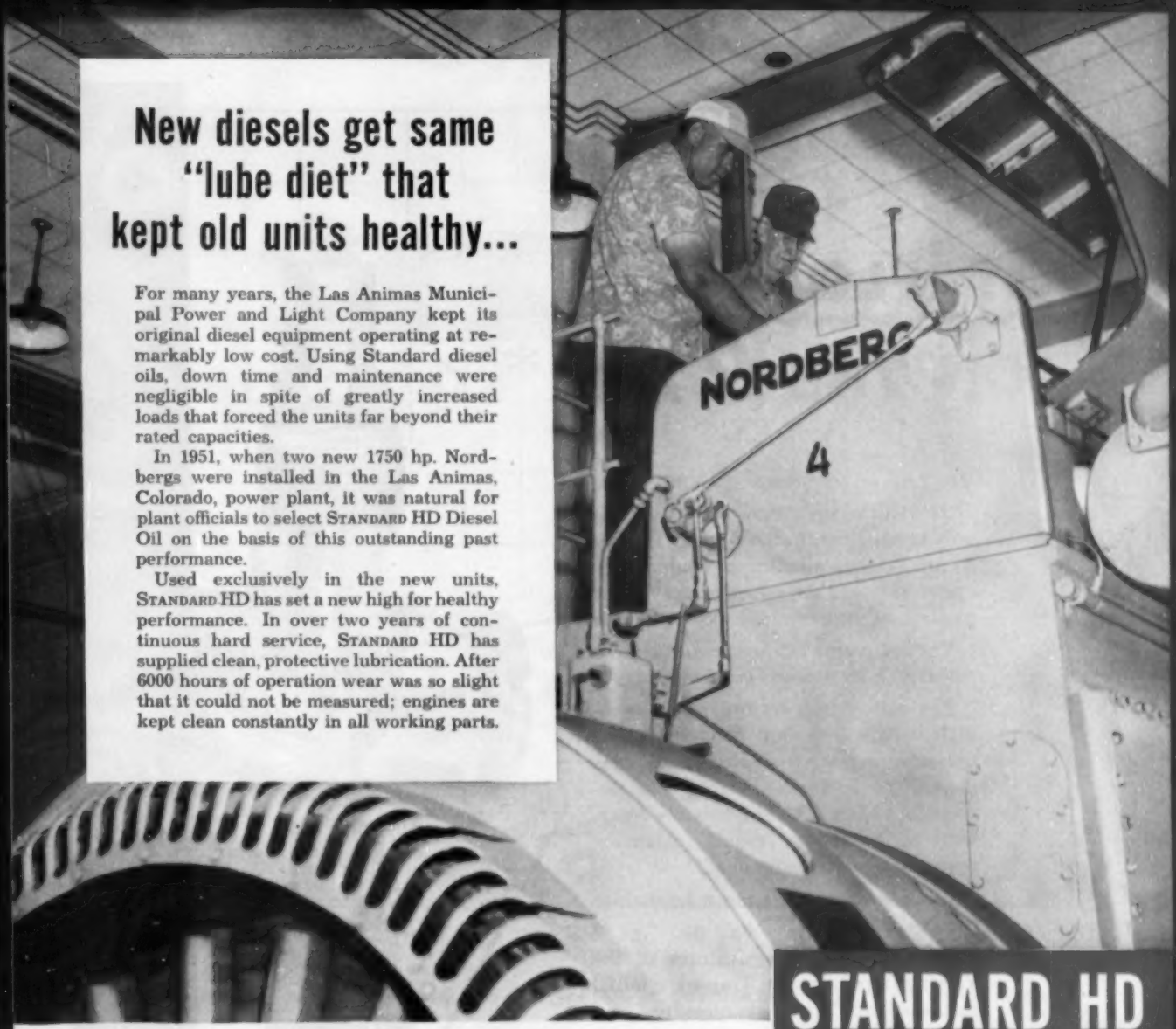
New diesels get same "lube diet" that kept old units healthy...

For many years, the Las Animas Municipal Power and Light Company kept its original diesel equipment operating at remarkably low cost. Using Standard diesel oils, down time and maintenance were negligible in spite of greatly increased loads that forced the units far beyond their rated capacities.

In 1951, when two new 1750 hp. Nordbergs were installed in the Las Animas, Colorado, power plant, it was natural for plant officials to select STANDARD HD Diesel Oil on the basis of this outstanding past performance.

Used exclusively in the new units, STANDARD HD has set a new high for healthy performance. In over two years of continuous hard service, STANDARD HD has supplied clean, protective lubrication. After 6000 hours of operation wear was so slight that it could not be measured; engines are kept clean constantly in all working parts.



STANDARD HD
TRADE MARK
OIL

Ralph Barbee, plant superintendent of the Las Animas Municipal Power and Light Company, checks the operating log with E. C. Jeffries, Standard Oil lubrication specialist.

• Diesel plant operators throughout the Midwest have discovered they can count on low cost diesel operation when they use STANDARD HD Oil. STANDARD HD provides an economical solution for costly maintenance problems—ring sticking and breaking, carbon deposits, cylinder wear—because STANDARD HD Oil lubricates, cleans *and* protects.

A Standard Oil lubrication specialist stationed near your plant throughout the Midwest can help you secure successful results in the operation and maintenance of your diesels. For his services, call your local Standard Oil Company office. Or write: Standard Oil Company (Indiana), 910 S. Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY
(Indiana)

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IT FLOATS ON THE LOAD!*

You turn on the steam.

This little stainless steel valve—the only moving part in the Yarway Impulse Steam Trap installed on the equipment—opens wide and *stays* open as the air and condensate continuously pour through.

The equipment reaches production temperature in the quickest possible time.

Production temperature reached, the little valve snaps shut. After that, by a pulsating action, it discharges all condensate as it forms—even a tiny teaspoonful. *There's hot steam in the equipment all the time . . .* steady, maximum temperatures are maintained.

It all adds up—to more production per day.

Other profit-making features of the Yarway Impulse Steam Trap—low initial cost, easy installation, stainless steel construction, low maintenance, good for all pressures, quick delivery from over 200 local industrial distributors.

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For free Yarway Impulse Steam Trap Bulletin T-1740, write . . .

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. . . resulting in fast heat-up of equipment, more production per day.

YARWAY | *impulse steam trap*

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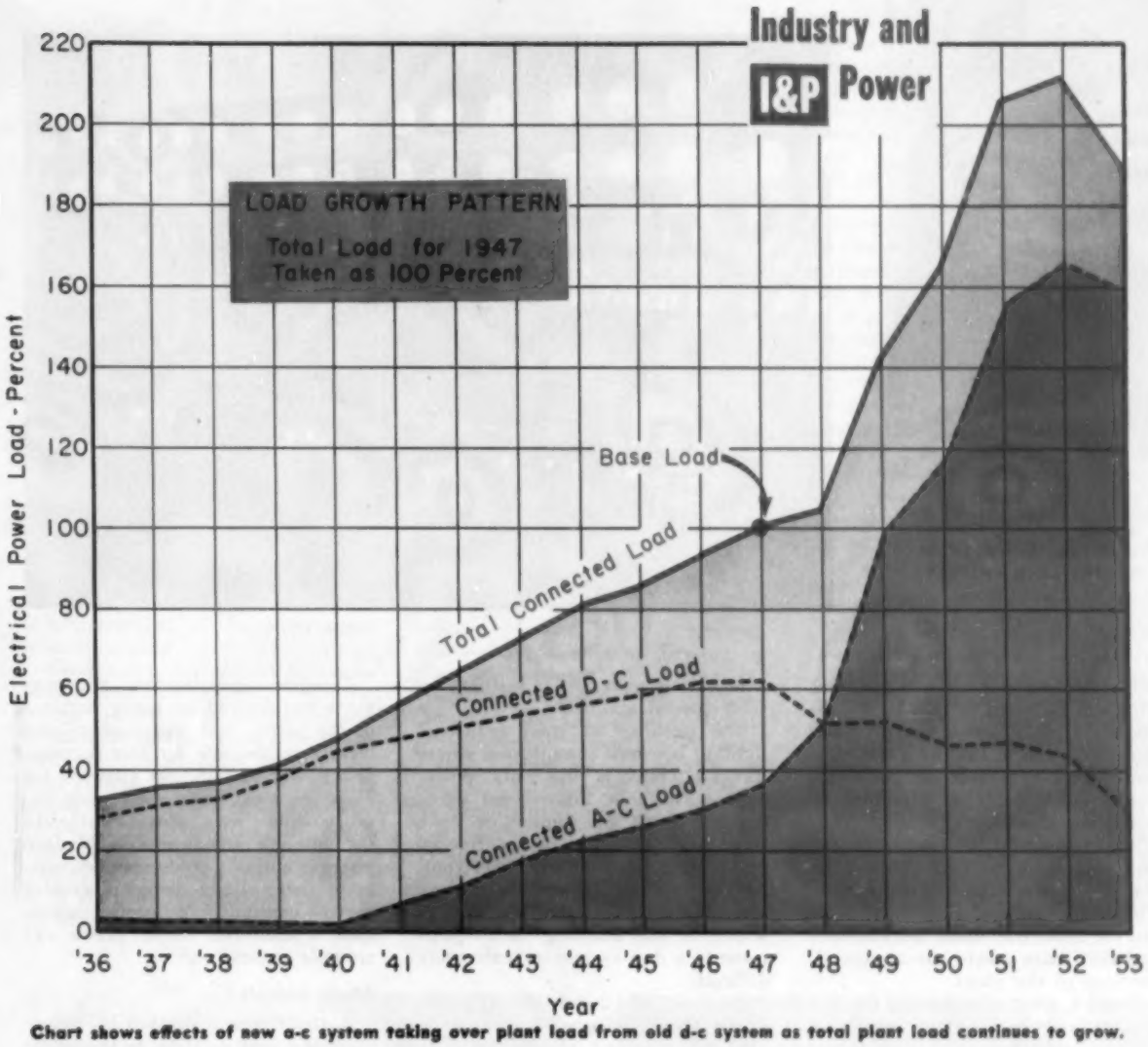


Chart shows effects of new a-c system taking over plant load from old d-c system as total plant load continues to grow.

Our Ten-Year Plan to

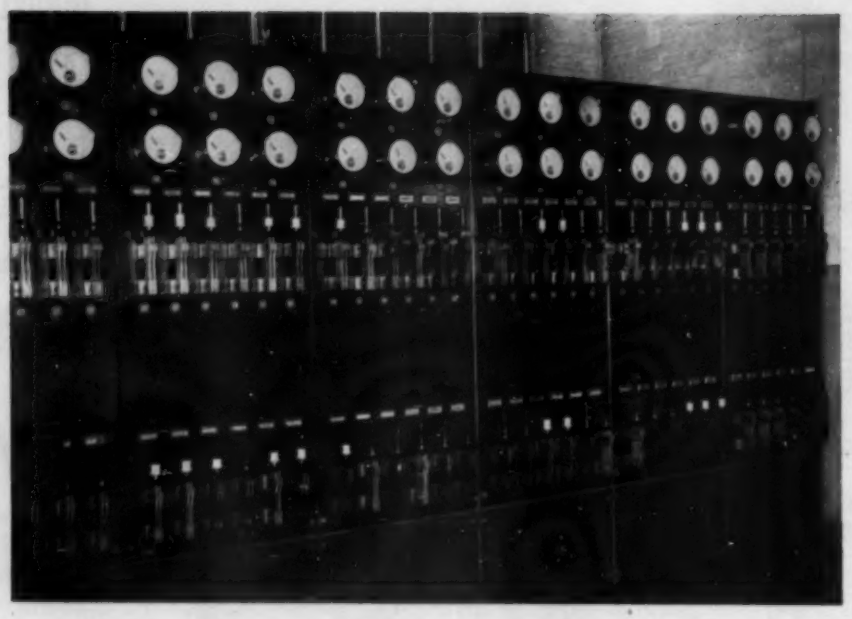
Changeover From DC to AC

HERVE H. HUNT
Assistant Superintendent of Engineering
Parke, Davis and Company

LONG BEFORE the turn of the century—as soon as electric power had become commercially feasible—Parke, Davis and Company's Detroit Plant was successfully generating electric power in its own plant. Kilowatts were being delivered when electric power was as revolutionary as is nuclear power today. Electric power was generated, distributed, and used at nominally 120 volts, d-c.

In the light of technical limitations then existing, it is easy to understand the reasons prompting the initial choice of direct current. Alternating current techniques had not been well developed, and practical induction motors or transformers were not commercially available. Adequate insulation techniques for higher distribution voltages were in the future. Furthermore, only relatively small blocks of power were required and distribution distances were short; the need for high distribution voltages was not a problem. The d-c system stood the test of time. It grew with the company, passing through three war periods and through a decade of company expansion almost without parallel in the industry.

The year 1923 saw the installation of two 500-kilowatt turbo-generators. In 1927, an additional 500-kilo-



One of hundreds of d-c motors replaced (above); main d-c board (right) sports open switches.

watt turbine generator was installed. This was followed in 1936 by the installation of a 500-kilowatt diesel generator, and in 1940 by a 500-kilowatt motor-generator set. All of the above equipment is currently in operating condition.

Approximately 100 tons of copper and lead underground cable form the d-c power distribution system. Thirty-six pairs of 1000-mcm cable are fed from the main switchboard and distribute power to almost all portions of the plant.

From a simple beginning, the d-c system grew to the point where by 1947 it was regularly distributing over 1800 kilowatts to the total plant electrical load.

DC Inadequate

As time went by, it became increasingly apparent that direct current is seriously inadequate for modern industrial power distribution in many important aspects. In the first place, d-c power generally must be distributed at the utilization voltages, since voltage transformation of direct current is difficult and costly. High cabling costs and high switching costs are encountered where heavy blocks of power are involved. Where long distances must be traversed, power line losses are excessive. D-c motors and controllers are high in initial cost and high in upkeep cost, comparing unfavorably with alternating current induction motors for the majority of industrial applications. D-c motors find acceptance only in highly specialized fields of speed and torque control where their high cost is justified by their special abilities.

The problem of good industrial lighting becomes complicated where direct current is the only power source available. Fluorescent lighting is difficult and impractical on a large scale from d-c power. Special equipment, particularly electronic devices, almost universally require alternating current. The problem of acquiring and adapting such equipment to a d-c system is extremely difficult.

Because of these limitations, Parke-Davis adopted a policy in 1940 of providing alternating current power in all new building construction. This had effect of the blunting d-c load growth. To reinforce and implement this decision, a primary switch house was installed in 1947, and provisions were made for underground primary a-c electric power distribution to many parts of the plant.

Remedial Action

By early 1948, it became painfully apparent that positive remedial action should be taken regarding the existing d-c system. The major portion of the d-c generating equipment was approaching the end of its useful life. Furthermore, the d-c load was still growing at an alarming rate even though a small amount of a-c facilities had begun to appear. The d-c load had reached the full firm generating capacity of the company's station. Distribution cable was generally fully loaded and not suitable for additional growth.

Comprehensive lighting improvement was desired for many portions of the plant, and the system was clearly inadequate for this purpose. D-c power in sufficient quantity for even the most basic emergency requirements was not available through any outside source. Modern pharmaceutical processing equipment increasingly demands greater service continuity for proper operation; a shutdown could prove extremely expensive.

Study Instituted

A study was instituted to determine the best solution to the problem. Four approaches were considered:

1. Purchase new d-c generating equipment and install additional distribution facilities;
2. Overhaul and supplement the existing d-c generation capacity;
3. Discard the entire d-c system, replacing it with a plant-wide a-c system; or
4. Use one or more combinations among the above alternatives.

After a thorough study, it was decided that the first and second alternatives were not feasible. To adopt either of those would be to embrace d-c power as a permanent, major, and significant portion of the power system; all of the d-c liabilities would be perpetuated on a permanent basis.

The third plan was seriously considered since it would mean an immediate solution to the total problem. However, it was not felt advisable to convert the entire plant

rapidly. Not only would this represent a very substantial immediate investment, but it would also present a serious scheduling problem and would undoubtedly adversely affect plant operation. Furthermore, many of the d-c motors and controllers were still in excellent condition, and much useful life would have to be written off prematurely.

Program Approved

The electric power conversion program which was finally approved was developed along the following lines: First, a-c distribution facilities are to be installed throughout all portions of the plant; this system is to include substations, primary and secondary distribution cables, lighting transformers, bus duct, plus power and lighting distribution panel boards. Secondly, incandescent lighting loads are to be removed from the d-c system and connected to the new a-c system. Fluorescent lighting is to be added in the plant areas where required.

Since a-c power would be available throughout the plant, all new equipment would be purchased and installed to operate from alternating current, completely halting d-c load growth. Third, any d-c motors which would require replacement by reason of age, condition, or obsolescence are to be replaced with a-c motors. Other equipment conversions are to be scheduled as the need presents itself.

The program was approved in April 1949 for full conversion on an extended basis running through 1958. The speed of conversion would be set by the practicality of reducing the d-c load to a reasonable level which the power plant could handle, and by shifts in the construction cost picture as time progressed.

The a-c primary system is generally of the radial type with primary selective cables for loads where service continuity is most important. Secondary loop ties have been installed where feasible.

System Standardized

Electric power distribution standards have been adopted as follows: primary service is 4800-volt, 3-phase, 3-wire, 60-cps service from the Detroit Edison Company; secondary voltage is 480-volt, 3-phase, 3-wire, 60-cps distributed by bus duct or by cable in conduit as advisable; lighting service is 120/208-volt, 3-phase, 4-wire, or 120/240-volt, single-phase, 3-wire as dictated by plant requirements.

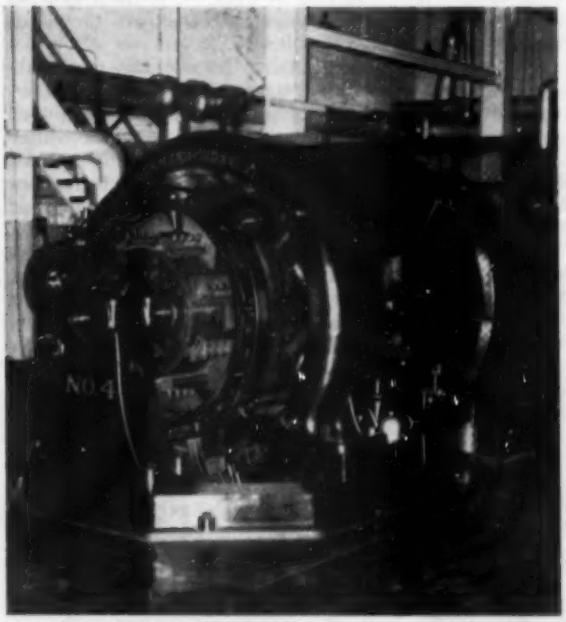
To date, the d-c demand has been reduced to less than 50 percent of its pre-conversion maximum. A major outage on two d-c generators can presently be tolerated without having replacement required.

Approximately nine transformer substations have been installed together with associated primary switching, underground cable work, and secondary distribution facilities. Alternating-current power is now available in all portions of the plant and in sufficient quantity for all reasonably foreseeable demands. It appears that the project may reasonably be completed by the end of 1958 as planned.

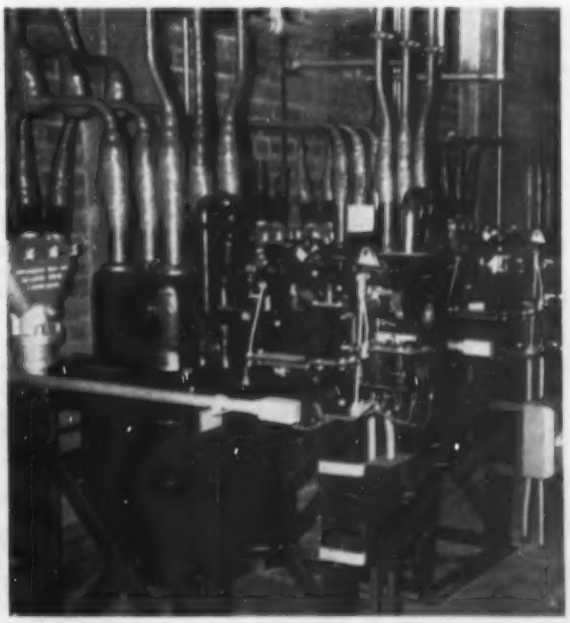
The entire project was considered to be economically sound considering—among other things—the cost of purchased a-c power compared with the cost of generated d-c power. A preliminary study has been completed regarding the advisability of installing a-c generating facilities. The feasibility of generating alternating current will be decided separately, since it must be defensible on its own merits based on a cost comparison with purchased a-c power. Many industrial plants install generating equipment where power can be generated as a by-product of other steam usage.

Completion in 1958

From an early start in the electric power generating field, Parke-Davis operated quite successfully for many decades with direct current. Modern technology, economics, and the march of events demand change. For these reasons, the complete program for conversion from direct current to alternating current has been instituted. It will reach full culmination in 1958, resulting in an entirely rejuvenated and comprehensive alternating current system, adequate for the years to come.



This 140-kw, d-c reciprocating steam engine driven generator was installed in 1898; it still serves as standby.



Portion of primary switchhouse installed in 1947 to handle the incoming a-c power for the changeover.

Corps of Engineers

Aerial view Fort Randall Dam taken late 1953. Since then, the first of eight 40,000-kw generators was put on the line.

Heat Pumps Serve Ft. Randall

G. T. WORK, Manager
Omaha Branch
Worthington Corp.

AN UNUSUAL FEATURE of the Fort Randall Dam, now under construction in Pickstown, South Dakota, is the installation of heat pumps to heat or cool the entire powerhouse.

The dam itself is a part of the Missouri River development under the Pick-Sloan Plan for soil conservation, flood protection, and navigation. A huge hydro-electric power plant was added to utilize the pent-up energy of the impounded water as it is released from the reservoir to maintain uniform stream flow in the lower Missouri Valley.

Powerhouse

The powerhouse structure is as massive in proportion as the big earthen dam and spillway. Constructed of reinforced concrete with glass brick for day-time lighting, the main generator room is 614 ft long and 77 ft wide. The roof structure is 53 ft above the generator room floor and 82 ft above the main floor of the building. This part of the building houses eight, 40,000-kw water wheel driven generators and their control mechanisms. A service area 95 ft by 114 ft is located at one end of the building to house the auxiliary equipment, machine shop, control room, and operating office space.

Climatic Conditions

Because dry bulb temperatures in the summer are often near the 100 F mark, comfort air-conditioning is almost a necessity for the operating personnel. Design conditions for summer air-conditioning in this area are 95 F dry bulb with 78 F wet bulb. However, in the winter, cold air moving in from the north may push the temperatures down to minus 25 F or lower.

The Army Corps of Engineers calculated that approximately 3 million Btu's per hour would be required for the service area alone for winter heating. The generator air coolers will remove most of the heat from the units but there will be sufficient radiation from the housings to maintain a reasonably comfortable temperature in the generator building, particularly if two or more units are in operation. No auxiliary heating is required in that area except to protect the equipment from freezing temperatures in the event of a shut-down or other emergency.

Accepted Heating Practice

Since the cost per kilowatt for electricity is relatively low in a hydro plant, the generally accepted practice for heating structures of this type has been to utilize electric heaters. However, in this instance the heating requirements were estimated at three million Btu per hour, which is the equivalent of al-

most 900 kw, a lot of energy to be used solely for space heating.

The Army Engineers took this reduction in the firm output capacity into consideration and were determined to reduce the power requirements for heating. This lead to the investigation of the possible application of a heat pump.

Since the water leaving the generator air coolers is approximately 10 F warmer than the water in the reservoir from which it is drawn, it was reasoned that this constituted a heat loss that could be partially recovered. Further investigation showed that by using a heat pump, a part of this water could be chilled down to 44 F and the required 3 million Btu could be recovered at a temperature of 120 F with a power input of only 250 kw. In other words, the heat equivalent of 3.6 kilowatts can be made available for each kilowatt of input. It is also possible to recover sufficient heat from the 40 F reservoir water to protect the generator room equipment during emergency periods; although the efficiency of the cycle is then somewhat reduced.

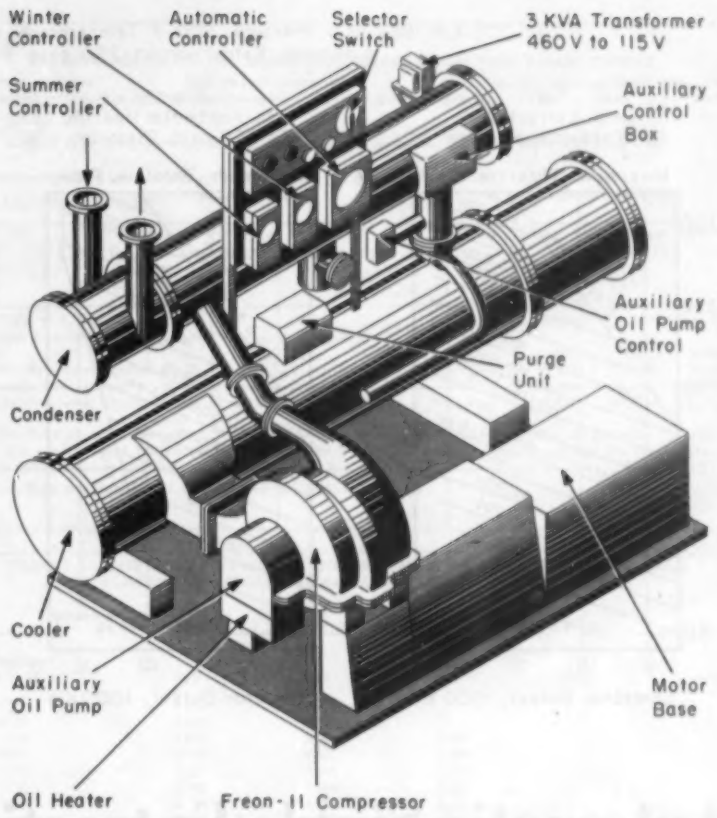
Description

The two heat pumps are essentially a standard product of Worthington Corp. and are of the well-known centrifugal compressor type generally used for air-conditioning service. Each three-stage compressor is driven through speed increasing gears by a wound rotor, variable speed induction motor rated 150 hp at 1750 rpm.

Freon II is used as a refrigerant, since the characteristics of this gas do not require the use of high pressures for condensing even at the relatively high temperature of the condensing water when used for heating.

The refrigerant condenser and the evaporative type water cooler are designed for the required flow of water and arranged so that during the summer, the river water is pumped through the heat pump condenser and wasted back to the river. The chilled water is circulated through the cooler and the coils in the air handling units.

During the winter heating season, the water cycle is reversed and the reservoir water is pumped through the cooler after having first passed through the generator air coolers. It is then wasted to the river. Thus, a part of the heat from the generator air coolers that would normally be wasted to the river is recovered and transferred to the heat pump condensing water, which is in turn recirculated through the coils in the air units heating the powerhouse.

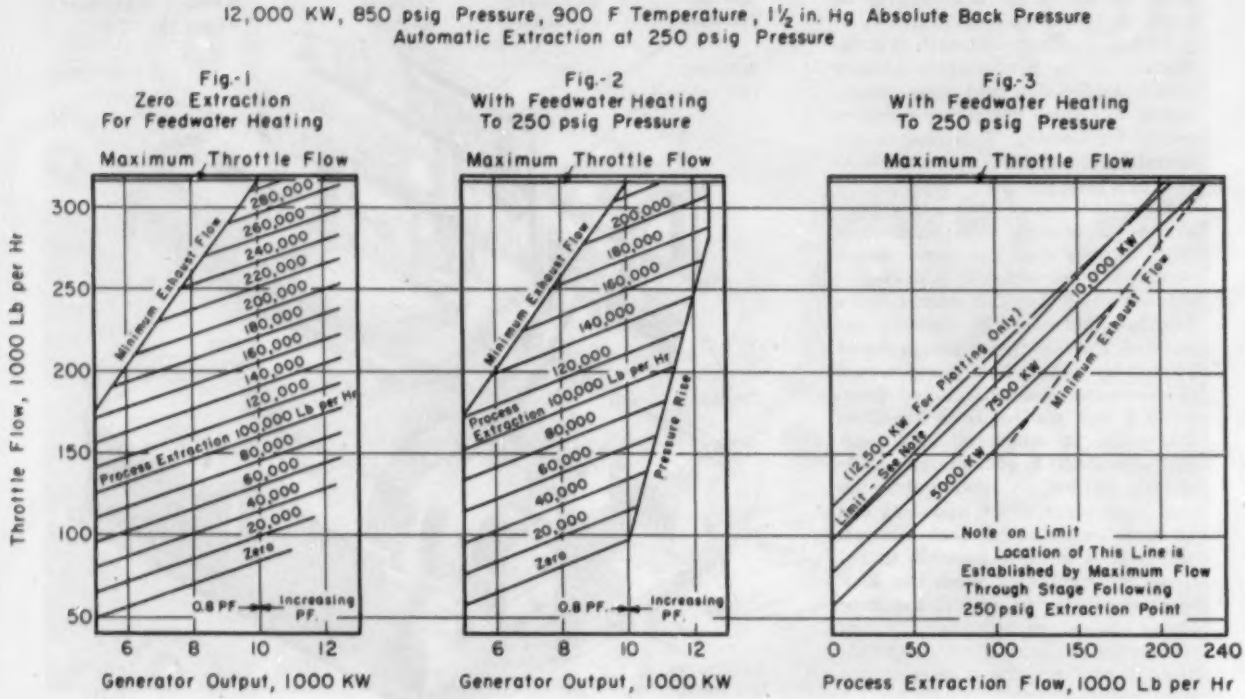


Two of these three-stage centrifugal compressor type heat pumps, driven by induction motors, are used in the powerhouse. Water temperatures are maintained automatically both summer and winter by thermostatic controllers.

Water temperatures are maintained automatically both summer and winter by thermostat controllers. These control the speed of the motors to regulate the output of the compressors to meet the requirements of the system. Intermediate controls, by means of suction dampers, are also provided. The change from heating to cooling is accomplished by a simple change in the valve settings which changes the flow of water from condenser to cooler and a transfer of the controls from the heating to cooling control instruments. No mechanical changes in the equipment are required.

Corps of Engineers

Looking upstream. The powerhouse in the foreground is under construction.


12,000 KW, 850 psig Pressure, 900 F Temperature, 1½ in. Hg Absolute Back Pressure
Automatic Extraction at 250 psig Pressure
Fig. 1
Zero Extraction
For Feedwater Heating
Fig. 2
With Feedwater Heating
To 250 psig Pressure
Fig. 3
With Feedwater Heating
To 250 psig Pressure
Maximum Throttle Flow
Minimum Exhaust Flow
Process Extraction 100,000 Lb per Hr
Pressure Rise
(12,500 KW For Plotting Only) Limit - See Note
10,000 KW
7500 KW
5000 KW
Note on Limit
Location of This Line is Established by Maximum Flow Through Stage Following 250 psig Extraction Point
Throttle Flow, 1000 Lb per Hr
Generator Output, 1000 KW
Process Extraction Flow, 1000 Lb per Hr
0.8 PF
Increasing PF

Automatic Single Extraction Turbines . . . Effect of Full Feedwater Heating

E. V. POLLARD, Section Engineer
Turbine Engineering Division
General Electric Company

NOMENCLATURE

- F_T = throttle flow, lb per hr
- F_o = throttle flow zero extraction, lb per hr
- F_{TP} = preliminary throttle flow or throttle flow with feedwater heating but without process extraction, lb per hr
- X = process extraction flow, lb per hr
- F_e = flow to condenser, lb per hr
- FFS = flow to stage following automatic extraction opening, lb per hr
- F_{CM} = minimum exhaust flow, lb per hr
- f_x = extraction factor, fraction
- h_f = final enthalpy of feedwater, Btu per lb
- h_c = enthalpy of liquid at condenser hotwell, Btu per lb

AUTOMATIC EXTRACTION steam turbines should be sized to provide feedwater heating to the maximum available temperature consistent with the automatic extraction pressure even though the steam flow for this service can be a surprisingly large fraction of the throttle flow. For example, an inspection of Figs. 1 and 2 indicates that at a selected condition of 10,000 kw load and 316,000 lb per hr throttle flow, the maximum extraction flows with zero and full feedwater heating are 306,000 and 229,500 lb per hr respectively. The 76,500 lb per hr difference is the steam extracted to heat the feedwater, and this, of course, greatly reduces the amount of steam available for process. Also, the boiler design is influenced by the turbine throttle flow and the feedwater temperature.

Single Automatic Extraction

Throttle flow with single automatic extraction is equal to the throttle flow with zero extraction

plus the extraction flow times the extraction factor (Eq. 1). The conventional single automatic extraction performance curve, Fig. 1, is constructed according to this formula, using data from the accompanying tables. The included minimum exhaust flow line is drawn through points plotted from data found by using the formula:

$$\frac{F_o \text{ at specific load} - F_{CM}}{(1 - f_x)} + F_{CM} \quad \text{(Eq. 2)}$$

Feedwater Heating

At a selected load, F_{TP} is the throttle flow with feedwater heating but without automatic extraction. With automatic extraction of X pounds per hour, the throttle flow is increased by $(X \times f_x)$. Since more feedwater also must be heated for this higher throttle flow, an additional extraction of

$$\frac{(h_f - h_c) \times (X \times f_x)}{1025}$$

pounds per hour is required which in turn increases the throttle flow by

$$\frac{f_x\,(h_f - h_c) \times (X \times f_x)}{1025}$$

pounds per hour. Assuming the makeup for the process extraction is returned to the system at the condenser hotwell, then the throttle flow with automatic extraction plus feedwater heating is:

$$F_T = F_{TP} + (X \times f_x) + \frac{f_x\,(h_f - h_c) \times (X \times f_x)}{1025} \quad \text{(Eq. 3)}$$

Minimum Exhaust Flow

When calculating minimum flow to exhaust, assume that all of the process and feedwater heating steam leaves the turbine at the automatic extraction opening. This, of course, may be somewhat pessimistic at higher loads because it is based on the premise that turbine pressures at the lower uncontrolled openings are too low to supply steam to the feedwater heaters.

Throttle flow is found from Equation 2, while the maximum process flow at this condition is determined by solving Equation 3, after rearranging to the following form:

$$X = \frac{F_T - F_{TP}}{f_x + \dfrac{f_x^2\,(h_f - h_c)}{1025}}$$

These data are plotted on Fig. 3, throttle flow vs process extraction flow. It should be noted that in the calculation procedure the preliminary throttle flow is figured for one stage of feedwater heating.

Zero Process Extraction

The calculation procedure is continued to find the throttle flow zero

EXAMPLE FOR 12,500 KW SINGLE AUTOMATIC EXTRACTION STEAM TURBINE

850 psig pressure 900 deg F temperature 1½ in. Hg absolute back pressure
Automatic extraction at 250 psig pressure TSR_t = 6.122 lb per kwh TSR_x = 23.04 lb per kwh

With four stages of feedwater heating and top heater supplied from 250 psig line.

The following data are calculated using Tables 1, 2, 3, and 4:

Zero Extraction Operation

Load, kw	*Flow, lb per hr***		*Steam Rate, lb per kwh***
10,000	6.122 x 10,000/0.705 x 1.00 x 1.028	= 84,500	8.45
7500	84,500 x 0.795	= 67,175	8.96
5000	84,500 x 0.59	= 49,850	9.97
12,500	84,500 x 1.205	= 101,800	8.15

TSR_t/TSR_x = 6.122/23.04 = 0.266 Extraction factor = 0.757** (Fig. 8)
Minimum flow to exhaust = 10,200** lb per hr (Fig. 9)

Load	5000	7500	10,000
Throttle flow zero extraction, lb per hr	49,850	67,175	84,500
Extraction flow, lb per hr = 100,000 x extraction factor	75,700	75,700	75,700
Throttle flow with 100,000 lb per hr extraction	125,550	142,875	160,200

Throttle flows at other extraction flows are found in like manner (this is solution of Equation 1). These data are used to plot the conventional extraction performance curve (Fig. 1), except for the minimum flow to exhaust line which is found from Equation 2.

**These data are used in the step by step calculation program.

TABLE 1 — BASE ZERO EXTRACTION EFFICIENCIES AT 80 PERCENT OF RATED LOAD FOR CONDENSING SINGLE AUTOMATIC EXTRACTION STEAM TURBINES

At 200 F superheat, 1.5 in. Hg absolute back pressure, and 0.8 pf.

Rating, kw at 1.0 pf	*Main Pressure, psig* 400	600	850	1250	1450
2500	0.652	0.636			
3125	0.664	0.650			
3750	0.674	0.660	0.649		
5000	0.689	0.677	0.660		
6250	0.697	0.686	0.677		
7500	0.705	0.694	0.686		
9375	0.712	0.702	0.694		
12,500	0.721	0.712	0.705	0.698	0.695
15,625	0.727	0.720	0.712	0.706	0.703

TABLE 2—CORRECTION TO EFFICIENCY FOR SUPERHEAT

Superheat, deg F	*Efficiency Factor*
150	0.990
175	0.995
200	1.000
225	1.004
250	1.009
275	1.013
300	1.017
325	1.020
350	1.024
375	1.028
400	1.030
425	1.034

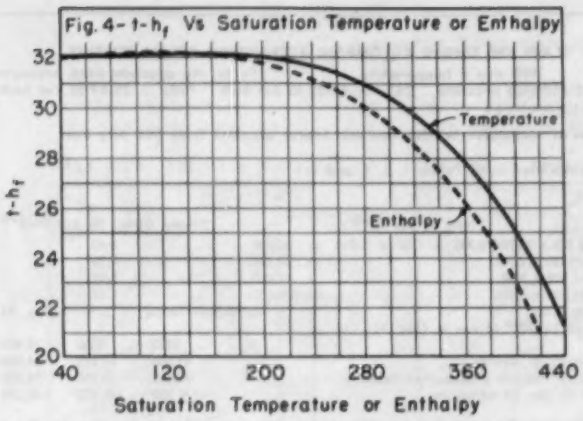
TABLE 3—CORRECTION TO EFFICIENCY FOR BACK PRESSURE

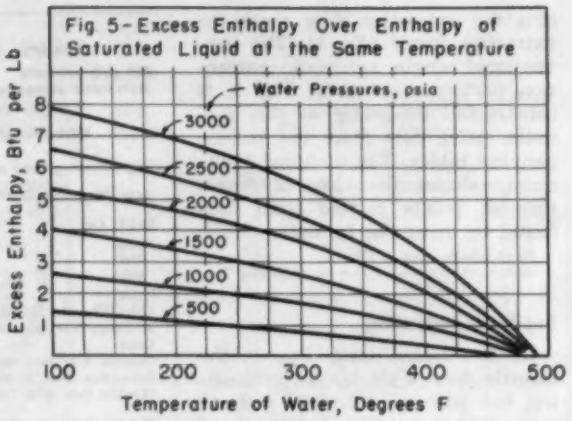
Design Back Pressure, in. Hg Absolute	*Efficiency Factor*
1.00	0.998
1.25	0.992
1.50	1.000
1.75	1.005
2.00	1.008
2.25 and above	1.010

TABLE 4—NONEXTRACTION FLOW FACTOR

Load, percent	*Nonextraction Flow Factor*
40 single extraction	0.59
60 " "	0.795
80 " "	1.0
100* " "	1.205

*For plotting purposes only as pressure rise starts at 80 percent load.





extraction with full feedwater heating. In this phase of the program, the total number of stages of feedwater heating are used in the computations. This information is added on Fig. 3, including the 100 percent load value which is calculated for plotting purposes only. Then a straight line is drawn between the throttle flow zero extraction values and the minimum exhaust flow points at analogous ratings to obtain the performance at constant load. No method is proposed for calculating intermediate process extraction flow points as it would be much more involved due to the variation in the number of effective heaters as exhaust flow changes.

Limit Line

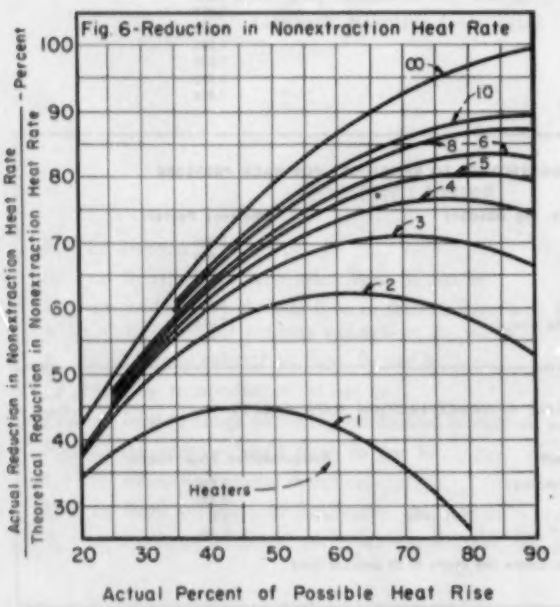
One further detail is required to complete Fig. 3. This is determining the location of the limit line for maximum throttle flow at 10,000 kw load with minimum exhaust flow based on the maximum flow through the nozzle following the automatic extraction opening. When calculating these data, the procedure assumes that minimum extraction at the automatic opening is for the last stage of feedwater heating only (one-quarter of the total extraction flow to heat feedwater for a four heater arrangement) which is accurate enough for the intended purpose. Based on this assumption, the formula for throttle flow becomes:

$$F_T = \frac{FFS + \text{Process Extraction}}{1 - \dfrac{\text{Extraction Percent}}{\text{Numbers of Heaters} \times 100}} \quad \text{(Eq. 4)}$$

Fig. 2 is a cross-plot of Fig. 3. It looks like the conventional automatic extraction performance curve, but the lines are for constant process extraction flow. The feedwater heating extraction flow is apparent only at the minimum exhaust flow line. The large difference between throttle flow and process extraction flow at this condition is predominantly feedwater heating extraction flow. At minimum and other low exhaust flow conditions, a deaerator in the system would be supplied by steam from the automatic extraction line, or when possible from an intermediate line, so that it would always function.

Boiler Feed Pump Work

Basic information to facilitate use of the calculation procedure is included on Figs. 4 to 10 inclusive. However, these data do not include enthalpy increase due to boiler feed



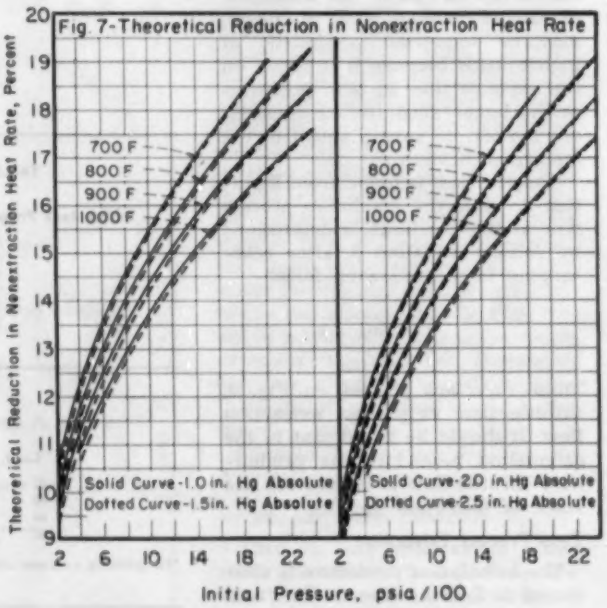
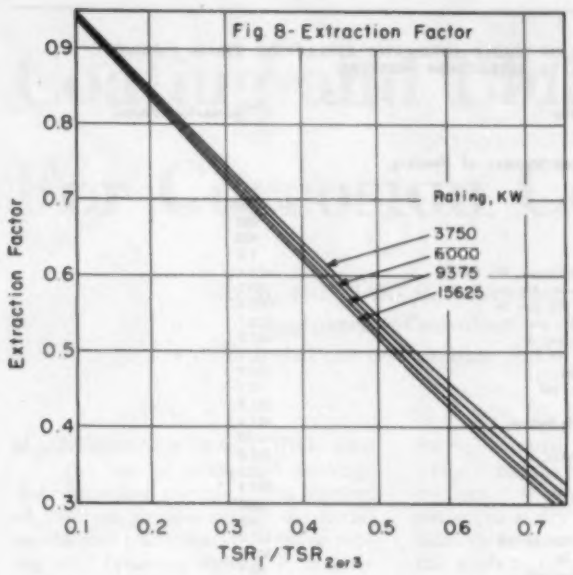
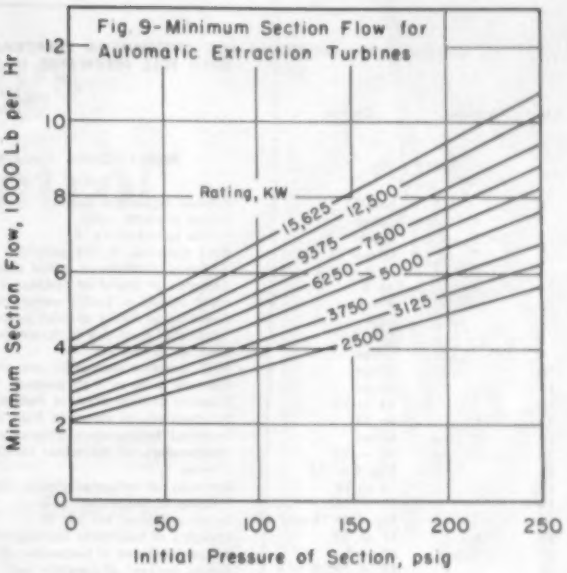


Fig. 7 - Theoretical Reduction in Nonextraction Heat Rate
Theoretical Reduction in Nonextraction Heat Rate, Percent
700 F
800 F
900 F
1000 F
Solid Curve - 1.0 in. Hg Absolute
Dotted Curve - 1.5 in. Hg Absolute
Solid Curve - 2.0 in. Hg Absolute
Dotted Curve - 2.5 in. Hg Absolute
Initial Pressure, psia / 100





pump work or the power requirements of the pump. When allowance for these items is desired, calculate the net effective input to the pump as follows:

$$\frac{F_T \times A \times 0.7}{B \times C \times 3413}$$

where F_T = Throttle flow, lb per hr

A = Isentropic work of liquid compression, Btu per lb, (Fig. 11). Note: Use water pressure = 1.25 × throttle pressure, psia

B = boiler feed pump efficiency, fraction

C = efficiency of driver, fraction

0.7 = factor which allows for the net effect of boiler feed pump work on the heat rate.

Then add this value to the desired generator output, and enter Fig. 2 to find the throttle flow.

A sample conclusion from comparisons of data taken from Figs. 1 and 2 illustrates the effect of feedwater heating. The values are based on a 10,000 kw load with process extraction of 200,000 lb per hr.

From Fig. 1

Throttle flow, lb per hr	=	235,900
Initial enthalpy	=	1453.1
Enthalpy of feedwater	=	59.7
Heat added, Btu per lb	=	1393.4
Total heat added, Btu per hr	=	328.7 × 10^6

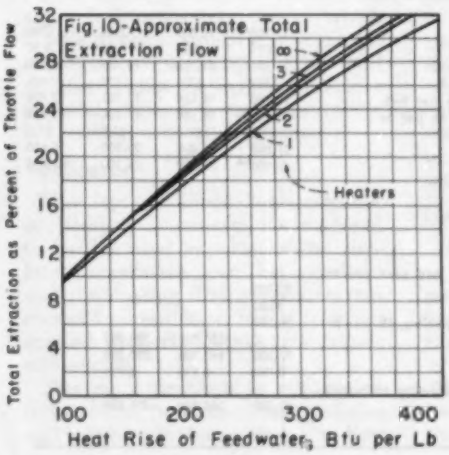
From Fig. 2

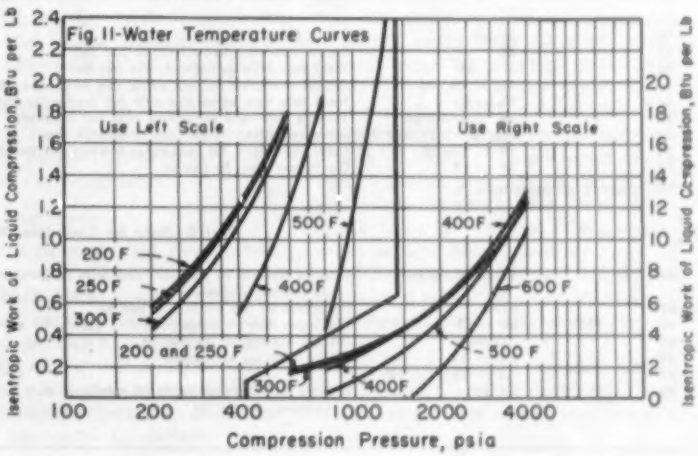
Throttle flow, lb per hr	=	288,000
Initial enthalpy	=	1453.1
Enthalpy of feedwater	=	367.0
Heat added, Btu per lb	=	1086.1
Total heat added, Btu per hr	=	312.8 × 10^6

Thus, the approximate theoretical gain due to addition of feedwater heating is 15.9 x 10^6 Btu per hr. This amount, however, will be decreased by a very small increment because of the difference in boiler feed pump power arising from the difference in throttle flow.

From an inspection of Figs. 1 and 2, it is apparent that the maximum process extraction capacity of an automatic extraction turbine is reduced at a given load when operating with full feedwater heating extraction. This should be considered when a turbine is selected. It is possible that a larger turbine should be used for the application.

Since this material is concerned only with performance of the turbine with and without feedwater heating, proper allowance should be made for boiler efficiency, auxiliary losses, and other individual project conditions when fuel costs are calculated. The attached tables have been simplified for convenience and are slightly approximate, but decisions regarding steam conditions or performance may be satisfactorily based on these data.



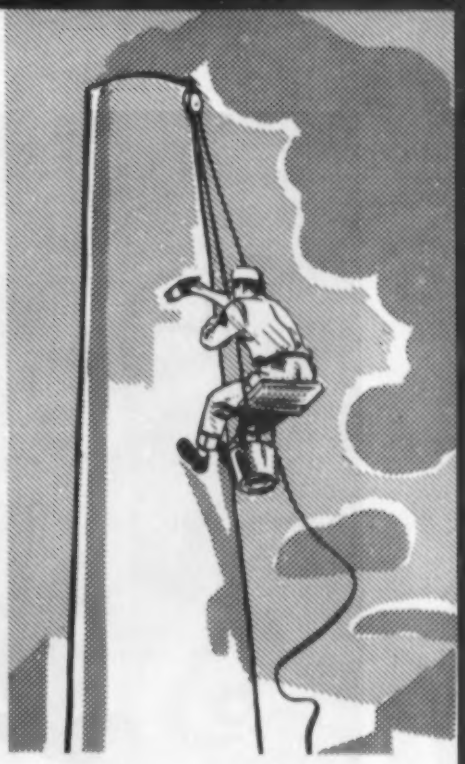


CALCULATION PROCEDURE FOR DETERMINING PERFORMANCE OF SINGLE AUTOMATIC EXTRACTION STEAM TURBINES WITH FULL FEEDWATER HEATING TO EXTRACTION PRESSURE

Line	Symbol	Source	Description	Numerical Values			
			Part 1—Steam Conditions and Number of Heaters				
0		Limits	Process extraction flow	Maximum	Zero		
1	P_1	Given	Initial pressure, psig	850			
2	T_1	Given	Initial temperature, F	920			
3	P_2	Given	Back pressure, in. Hg absolute	1.5			
4	H_o	At 1 and 2	Enthalpy of steam at initial steam conditions, Btu per lb	1453.1			
5	h_c	At 3	Enthalpy of liquid at condenser pressure, Btu per lb	59.7			
6		4 —5	Heat added in boiler, nonextraction, Btu per lb	1393.4			
7		At 1	Enthalpy of liquid at inlet pressure, Btu per lb	520.7			
8		7 — 5	"Possible" heat rise of feedwater, Btu per lb	461.0			
9		Given	Number of heaters	1	4		
10		Given	High pressure extraction pressure, psia	264.7			
11		Given	Pressure drop to high pressure heater, psi	13.2			
12		10 — 11	Pressure at high pressure heater, psia	251.5			
13	t	At 12	Temperature of steam in high pressure heater, F	401.6			
14	θ	Given	Terminal temperature difference, F	10			
15	t	13 — 14	Temperature of feedwater leaving heater, F	391.6			
16		Fig. 4 at 15	t — h_f	25.7			
17		15 — 16	Enthalpy of saturated liquid, Btu per lb	365.9			
18		(1 + 15) × 1.25	Pressure of feedwater, psia	1080			
19		Fig. 5 at 15 and 18	Excess enthalpy, Btu per lb	1.1			
20	h_f	17 + 19	Enthalpy of feedwater leaving heater, Btu per lb	367.0			
21	h_f-h_c	20 — 5	Actual heat rise of feedwater, Btu per lb	307.3			
22		21 × 100/8	Actual percent of possible heat rise, percent	66.7			
23		Fig. 6 at 9 and 22	Actual reduction in nonextraction heat rate, percent / Theoretical reduction in nonextraction heat rate, percent	37.9	75.2		
24		Fig. 7 at 1, 2, and 3	Theoretical reduction in nonextraction heat rate, percent	13.62			
25		23 × 24/100	Actual reduction in nonextraction heat rate, percent	5.16	10.24		
26		4 — 20	Heat added in boiler, Btu per lb	1086.1			
			Part 2—General Data				
27	f_x	Fig. 8	Extraction factor, fraction	0.757			
28		27 × 27 × 21/1025	$f_x^2(h_f - h_c)/1025$	0.172			
29		27 + 28	$f_x + f_x^2 (h_f - h_c)/1025$	0.929			
30		1.0 — 27	$(1 - f_x)$	0.243			
31		30 × 21 × 27/1025	$(1 - f_x) \times (h_f - h_c) \times f_x/1025$	0.055			
32		30 + 31	$(1 - f_x) + (1 - F_x) \times (h_f - h_c) \times f_x/1025$	0.298			
			Part 3—Calculation of Maximum Process Extraction Flow With Minimum Exhaust Flow				
			Note: Use Data From Part 1 Under Heading Maximum Process Flow				
33		Select	Load, kw	10,000	7500	5000	
34		Fig. 1 at 33	Steam flow zero extraction, lb per hr	84,500	67,175	49,850	
35		34/33	Steam rate zero extraction, lb per kwh	8.45	8.96	9.97	
36		6 × 35	Heat rate zero extraction, Btu per kwh	11,770	12,480	13,900	
37		36 × 25/100	Actual reduction in zero extraction heat rate, Btu per kwh	608	644	717	
38		36 — 37	Heat rate zero automatic extraction with full feedwater heating, Btu per kwh	11,162	11,836	13,183	
39	F_{ZP}	38 × Load/26	Preliminary throttle flow, lb per hr	102,800	81,700	60,700	
40	F_{CM}	Fig. 9	Minimum exhaust flow, lb per hr	10,200	10,200	10,200	
41		34 — 40		74,300	56,975	39,650	
42		41/30		305,800	234,500	163,200	
43	F_T	42 + 40	Throttle flow at maximum extraction, lb per hr	316,000	244,700	173,400	
44		43 — 39		213,200	163,000	112,700	
45	X	44/29	Maximum process extraction flow, lb per hr	229,500	175,500	121,300	
			Part 4—Calculation of Throttle Flow and Condenser Flow With Zero Process Extraction				
			Note: Use Data From Part 1 Under Heading Zero Process Flow				
50		Select	Load, kw	12,500**	10,000	7500	5000
51		35	Steam rate zero extraction, lb per kwh	8.15	8.45	8.96	9.97
52		6 × 51	Heat rate zero extraction, Btu per kwh	11,350	11,770	12,480	13,900
53		52 × 25/100	Actual reduction in zero extraction heat rate, Btu per kwh	1162	1206	1278	1422
54		52 — 53	Heat rate zero extraction with full feedwater heating, Btu per kwh	10,188	10,564	11,202	12,478
55	F_T	54 × Load/26	Throttle flow zero extraction with full feedwater heating, lb per hr	117,200**	97,300	77,300	57,400
56		Fig. 10 at 21 and 9	Total extraction as percent of throttle flow	27.1	27.1	27.1	27.1
57		55 × 56/100	Total extraction for feedwater heating, lb per hr	31,800	26,400	21,000	15,600
58	F_c	55 — 57	Condenser flow, lb per hr	85,400**	70,900	56,300	41,800
**For plotting purposes only.							
			Part 5—Data for Limit Line, Fig. 3				
60		55 at 10,000 kw	Throttle flow at 80 percent load with feedwater heating and zero process extraction, lb per hr	97,300			
61		57/9	Extraction to top heater, lb per hr	6600			
62	FPS	60 — 61	Maximum flow to stage following automatic extraction opening, lb per hr	90,700			
63		Assume	Process extraction, lb per hr	0	100,000	200,000	
64		62 + 63	FPS + process extraction	90,700	190,700	290,700	
65		1.0 — 56/9 × 100		0.935	0.935	0.935	
66	F_T	64/65	Throttle flow corresponding to maximum flow to stage following extraction opening, lb per hr	97,300	204,000	311,000	

Coating and Linings For Corrosion Control

L. R. HONNAKER, Supervisor
Engineering Consultants
E. I. duPont de Nemours & Co.



MAINTENANCE PAINTING and the use of protective coatings for combating corrosion is a subject of interest to almost all industrial plants and particularly to those facing acid fume conditions. It is generally agreed that a good protective coating job is dependent upon three main fundamentals: proper surface preparation, proper coating selection, and proper application. A compromise in any one of the three will seriously jeopardize chances of obtaining a good job.

Surface Preparation

Most of the studies on surface preparation have indicated that sand-blasting is the best method. It is always wise to remove mill scale from new steel. Recontamination after cleaning and before coating should be avoided. The best answer to the latter point appears to be to paint as soon after cleaning as is practical for the job.

Coating Selection

Coating selection should be based on type and severity of exposure. This should not present any serious problem of selection in most instances—there are hundreds of coating systems available comprising about fourteen types, one of which is able to resist almost any given set of corrosive conditions. The real problem is that coatings have serious physical limitations such as porosity, low strength, and brittleness.

Application

The last of three fundamentals, application, is generally considered to be the most important. The surface preparation can be excellent and the coating film adequately resistant to conditions, but if it is not applied properly, premature failure will occur.

The main problem in application is to obtain freedom from pinholes and holidays in the coating. The best way to assure good coverage over surface roughness, sharp edges, and corners is to apply multiple coats or passes to a dry film thickness of at least three times the profile depth of the surface roughness.

Requirements

Observances of the requirements for adequate coverage or film thickness will probably do more to assure a good coating life than any other single factor. Minimum desired dry film thickness in almost all cases is five to six mils. Much of the success of the fibrated mastic type of coating, which has proven to be quite good for severe industrial atmosphere exposure, is undoubtedly due to good coverage over rough area, corners, and the relative absence of porosity. These coatings are sprayed on to about ⅛ in. thickness and are tested with spark tester to detect pinholes and holidays.

It is unwise and generally uneconomical to try to use steel equipment coated with chemically resistant coatings for handling chemicals that are quite corrosive to steel. This results from the fact that it is difficult to avoid some pinholes or holidays in the coatings and rapid attack of the steel will occur at such points. The highly resistant coatings such as the baked phenolic resins and the various vinyl resins are ideal for minimizing contamination of chemicals handled in steel equipment, but they should not be used where 100 percent protection is required for the equipment.

Lining Compounds

Excellent progress has been made in developing rubber lining compounds, both natural and synthetic, for corrosive service applications and these have proven to be of real value in the field of corrosion engineering. They are useful and economical for handling many chemical solutions that are corrosive to metals. Rubber linings are particularly attractive for use where abrasive as well as corrosive conditions are involved. The cost of rubber lined steel equipment is generally competitive or lower in cost than corrosion resistant alloy construction, and it will provide good service life.

Limitations

At the present time the upper temperature limitation for rubber lining is 160-200 F, depending upon the rubber compound and chemicals involved. Rubber linings are frequently used in combination with brick linings where processing temperature conditions are above the limit for rubber, and they have proven to be good membrane linings for use in combination with brick lined steel constructions. A number of compounds are available which may be easily applied in equipment in plants, and almost all of the compounds may be readily and adequately repaired in the plant.

One of the developments that has done much to improve the serviceability of rubber linings is the spark test to detect pinholes in the linings and joints or seams. The value of the spark tests for rubber lined equipment is now recognized by most of the fabricators, and it can and should be made a condition of order and acceptance of new equipment.

Based on a paper presented before the recent Plant Maintenance and Engineering Conference and Show in Chicago.

Tal Bender, Inc.

The two main parts of the hydraulic bender—the hydraulic unit and the frame—can be quickly assembled with a U key.

Economies With Hydraulic Pipe and Tube Benders

This Chicago electrical contracting firm has effected relatively large savings on installations requiring conduit and piping runs by using a hydraulic bender to make conduit bends and offsets.

R. T. FRENCH
Superintendent and Chief Engineer
Johnson Electric Co., Chicago, Ill.

THE HYDRAULIC PIPE OR TUBE BENDER is a tool for economically bending the larger sizes of pipe or conduit (up to 6 in.) for piping installation work. It can also be used for bending larger sizes of thin-wall tubing up to 3 in. in diameter.

The advantage of using a hydraulic bender is that it eliminates the labor and materials otherwise necessary to thread conduit for installing couplings and elbows. The bender is equally useful in making offsets that are frequently required in conduit or piping runs.

Used in the shop or in the field, the bender is a simple device. After selecting the proper shoe for the size pipe being bent and the desired radius, a length of pipe is placed in the frame. A hydraulically actuated plunger forces the pipe to follow the contour of the shoes in the frame setting. The angle or offset having previously been marked on the floor, the pipe is bent to coincide with these markings.

When the Johnson Electric Co. connected an air compressor (250 hp,

220 volt, 3-phase) in the shop of the Diamond T Motor Car Co., they were able to show a savings by using a Tal Bender to bend conduit in place of elbows and couplings.

In the original estimate, the total value of the installation was $1995, with the electrical conduit work accounting for $665 worth of materials and labor. It was estimated the conduit installation would require 59 man-hours to complete. Actually, the job was finished in 39 man-hours by using a conduit bender. The need for a good number of fittings along with the labor necessary to install them was thus eliminated. A total savings of $134 was made: $64 in materials and $70 in labor.

Material savings were figured on the basis that 33 inches of conduit were necessary to make a 90 degree bend with 3 in. conduit. With fourteen bends requiring 38½ ft of conduit at $.85 per ft, the bending cost came to $32.72.

In comparison, using fourteen 3 in. couplings at $.91 each for $12.80; two 3 in. Erickson couplings at $11.40 for $22.80; and fourteen 3 in. elbows at $4.37 for $61.18; total cost for elbow and coupling materials came to $96.72.

Subtracting the actual cost of bending, left $64.00 as the gross savings. These savings did not take into consideration the scrap material that would have resulted with the use of threaded elbows and coupling fittings.

On the labor side, 20 man-hours were saved with the bending method. At $3.50 per man-hour this was worth $70.00.

The longest run was 15 ft with two parallel lengths, each with a 90 degree bend and an offset. A shorter run of two parallel 8 ft lengths also had two 90 degree bends and two offsets. The job was completed with two 90 degree bends in each length of four short 6 ft parallel runs.

On another job for the A. C. Nielsen Co., a Chicago marketing research firm, 12 parallel 3 in. conduits were run for power, lighting, and air-conditioning in a new building addition. Starting from the transformer bank outside of the building, the 12 conduits pitched to 16 ft below grade running north east for 40 ft and then ran 50 ft north into the building. No elbows were needed at all on the entire installation.

All the bends that have been made on these jobs with the hydraulic benders have been free of kinks, distortions, or wrinkles and done without filling or heating.

It seems that a certain amount of craft and skill is necessary to successfully bend tube with a hydraulic bender. Accuracy in measuring and bending to proper angles requires some judgment and experience. For instance, gaging the springback in different sizes of conduit is almost entirely a matter of experience.

Characteristics for all types of tubing are being established to help facilitate the bending process.

Tal Bender, Inc.

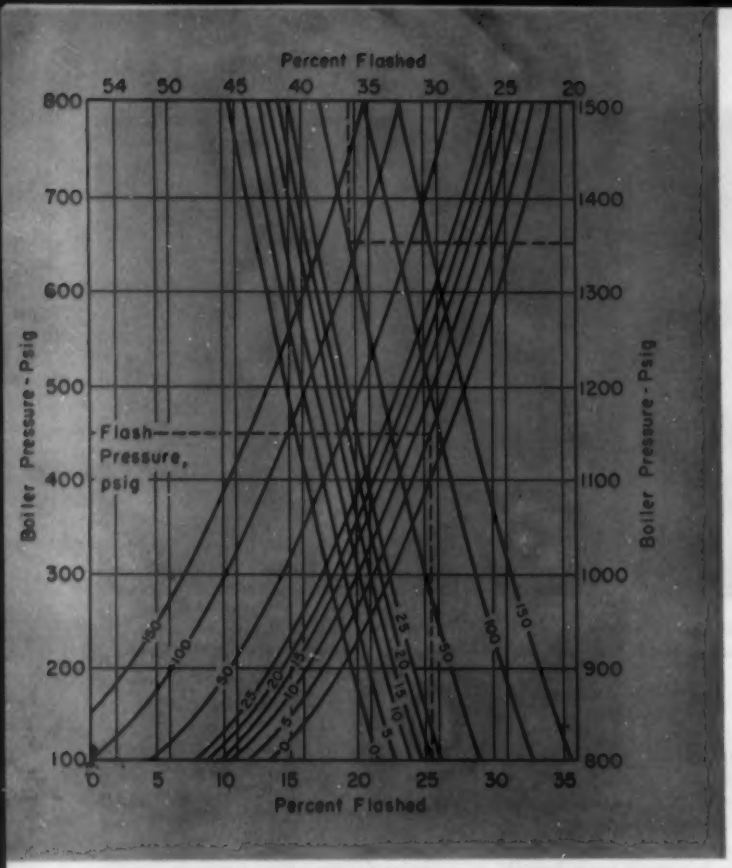
An installation of two runs of 3 in. conduit in parallel illustrates neat appearance of bends that can be made with this type of hydraulic bender.

Tal Bender, Inc.

The hydraulic bender makes a 90 degree bend with one single setting. It is not necessary to move the pipe.

Tal Bender, Inc.

To remove the completed pipe bend from the shoe, the operator manually actuates the push-out pin as shown.



Boiler Blowdown Control

W. L. NIELAND & J. H. RICHARDS
Chemical Engineers
W. H. & L. D. Betz

Fig. 1—Chart for calculating the percent of boiler water discharged by a continuous blowdown system that can be flashed into steam at a lower pressure and recovered for processing or feedwater heating.

THE TERM blowdown means to eject or drain part of the water from a system. In a boiler, blowdown is the process of removing some of the concentrated water and replacing it with feedwater, thus effecting a general lowering of concentrations in the unit. Usually, boiler blowdown is expressed in percentage of the total feed. For example, a 5 percent blowdown means that 5 percent of the water fed to the boiler is removed by blowdown. The percentage normally is determined by the chloride test, the formula and its algebraic derivation being as follows:

x = quantity of feedwater
y = quantity of blowdown water
a = chloride concentration in feedwater
b = chloride concentration in boiler water
k = percent blowdown = 100 y/x

Since total chlorides entering the boiler must equal total chlorides leaving the boiler xa = yb. Multiplying both sides of the equation by 100/xb equals:

100 a/b = 100 y/x

Since by definition 100 y/x = k, then k = 100 a/b or

$$\frac{\text{Cl in feed} \times 100}{\text{Cl in boiler water}} = \% \text{ blowdown}$$

Under normal operating conditions, blowdown serves to lower both the suspended solids and dissolved solids content of the boiler water. These solids are brought in by the feedwater, and since the steam leaving the unit is relatively pure, they will concentrate in the boiler water. Excessive amounts of suspended solids will cause deposition of sludge and may alter the surface tension of the boiler water. This effect, in turn, may be severe enough to cause carryover in the absence of suitable antifoam agents. Excessive amounts of dissolved solids have the same deleterious effects as suspended solids, and in addition, when the solubility of the salts present in the boiler water is exceeded, scale will be deposited.

The American Boiler Manufacturer's Association in its standard guarantee of steam purity stipulates the following limits for solids content of a boiler water:

Boiler Pressure psig	Total Solids ppm
0 - 300	3500
301 - 450	3000
451 - 600	2500
601 - 750	2000
751 - 900	1500
901 - 1000	1250
1001 - 1500	1000

These recommended limits for solids content are not entirely applicable to each individual case. Rather, they are limits of a general nature, providing a suitable basis from which to vary solids in accordance with the specific requirements of a particular plant.

During the past few years, highly effective antifoam agents have been developed. In many instances where they have been properly applied, excellent steam purity has been produced even though the total solids content of the boiler water was maintained considerably in excess of the stipulated ABMA range. In fact, frequently the effect of boiler water solids on steam purity need no longer be considered, and in such cases blowdown is used solely to control sludge concentrations for the prevention of deposits on the boiler heating surfaces.

Silica

Total solids content of the boiler water, however, is only one factor controlling boiler blowdown. With many boilers, especially those operating above 600 psig, blowdown is employed to keep the silica content of the boiler water below certain values in order to limit the amount of silica vaporized with the

steam. Vaporization of silica with the steam is not usually a problem where boiler pressures are maintained below 400 psig, but at higher pressures unless silica values are properly restricted, a siliceous type of scale may be deposited on the heating surfaces and turbine blades. Therefore, it is quite possible to find a plant operating with an apparently high blowdown rate even though ABMA limits might permit higher solids or the use of an antifoam agent might permit a very high total solids content before carryover occurred.

Other Influences

Other chemical factors which frequently limit the final percentage of blowdown are alkalinity and suspended solids. Both items effect the boiler water limits which are established as the control must meet the two objectives of producing pure steam and maintaining clean heat transfer surfaces. In addition, many mechanical factors influence the total solids concentrations which can be carried safely. These include boiler design, rating, water level, load characteristics, and whether water level and load are relatively constant or subject to extremely rapid variation.

Manual Blowdown

There are two principal types of boiler blowdown — intermittent manual and continuous. Manual or sludge blowdown is required regardless of whether or not continuous blowdown also is used. The take off point usually is located at the lowest part of the boiler so that part of the suspended solids or sludge, which generally is more concentrated in the lower parts of the boiler, will be removed in addition to the lowering of the dissolved solids concentration. At most plants two or more short manual blowdowns per day will provide proper sludge removal. However, when the feedwater is exceptionally pure, such as water from an evaporator, or where condensate returns are a high percentage of the feed, blowdown can be employed less frequently as very little sludge is formed.

If continuous blowdown is not installed, manual blowdown must be used whenever dissolved or suspended solids approach or exceed predetermined limits. In practice, the valve of the manual blowdown connection is opened periodically in accordance with an operating schedule or chemical control tests. From the standpoint of control, economy, and results, frequent short blows are preferred to infrequent lengthy blows. This is particularly true when the suspended solids content of the water is appreciable. With frequent short blows, a more uniform concentration of the boiler water is maintained, and in general, a smaller quantity of water is blown down because of the better control. However, some plants find it is undesirable from an operating standpoint to blow down a boiler manually with sufficient frequency to properly control concentrations, especially if the feedwater is high in solids content.

Continuous Blowdown

Continuous blowdown, as the name implies, is the continuous removal of concentrated water from the boiler. It offers many advantages not provided by the use of manual blowdown alone and may be considered an extension of the practice of frequent short blows. In actual plant practice, periodic adjustments are made in the setting of the control valve when test results indicate an increase or decrease in the boiler blowdown rate is required. Thus, close control of boiler water concentrations always is maintained.

Another important advantage of continuous blowdown is that heat recovery is possible. With the use of an efficient heat exchange unit, the only heat loss is the terminal difference between the temperatures of the incoming cooling water and the blowdown water being discharged to the sewer. This terminal difference usually amounts to about 20 F.

Flash Tanks

Using a flash tank prior to the exchanger, so that part (see Fig. 1) of the boiler water can flash into steam at the lower pressure, will further increase the economy which can be realized with continuous blowdown heat recovery systems. The resulting low pressure steam can be used quite readily for process, heating, or as is the usual case, for direct introduction into the feedwater heater as shown in Fig. 2. Furthermore, since a considerable portion of the heat recoverable from the boiler blowdown is contained in the amount of flash steam obtained, a smaller heat exchanger can be used thereby providing a definite saving in initial cost.

Savings With Heat Recovery

Table 1 illustrates typical calculations for determining the savings which can be achieved with a low pressure flash tank-heat exchanger type system. It should be noted, however, that the installation of re-

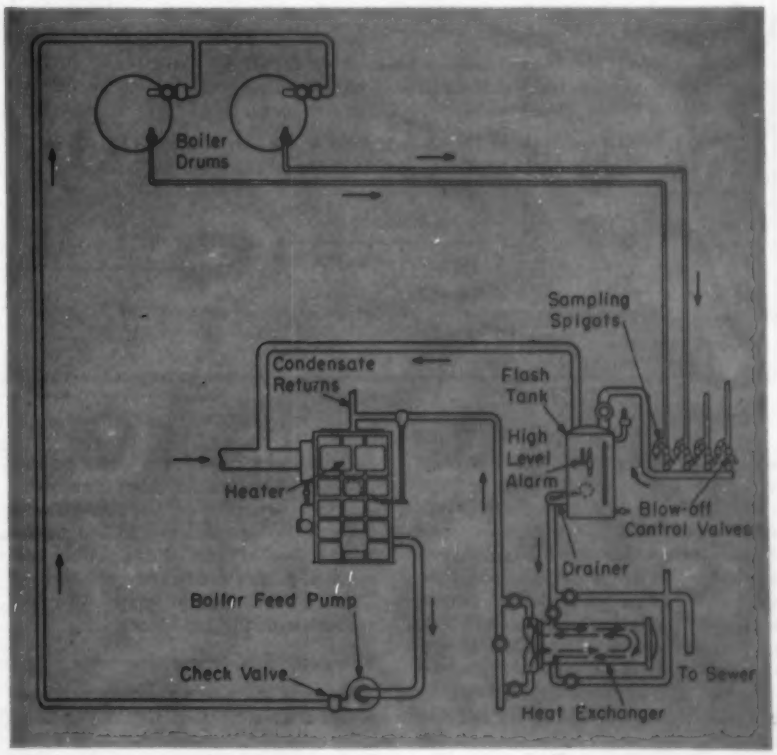


Fig. 2—Flash tank-exchanger type continuous blowdown heat recovery system.

TABLE 1 — CALCULATIONS FOR DETERMINING POTENTIAL SAVINGS WHEN USING HEAT RECOVERY EQUIPMENT WITH CONTINUOUS BLOWDOWN SYSTEMS

Basis · · · 1 day

Evaporation	=	2,000,000 lb steam
Boiler pressure	=	175 psig
Feedwater temperature	=	200 F (live steam)
Makeup water temperature	=	70 F
Rate of blowdown	=	6.0 percent
Boiler efficiency	=	77 percent
Fuel	=	Oil, 18,000 Btu per lb at 6¢ per gal
Feedwater	=	Steam plus blowdown
Feedwater	=	$\frac{2{,}000{,}000}{0.94} = 2{,}128{,}000$ lb
Blowdown	=	128,000 lb

When employing a flash tank at 5 psig, the quantity of 5 psig steam available may be calculated from the formula: —

$$\% \text{ flashed steam} = \frac{H_b - H_f}{V_f} \times 100$$

Where H_b = Heat of liquid at boiler pressure, Btu per lb
H_f = Heat of liquid at flash pressure, Btu per lb
V_f = Latent heat of vaporization at flash pressure, Btu per lb

$$\% \text{ flashed steam} = \frac{350.8 - 196}{960} \times 100 = 16.1$$

Flashed steam available at 5 psig = 128,000 lb × 0.161 = 20,600 lb
Total heat of flashed steam at 5 psig = 1156 Btu per lb
Heat in 70 F makeup water = 38 Btu per lb
Heat savings in flashed steam = 1118 Btu per lb × 20,600 lb = 23,030,000 Btu

Drain water from the flash tank passes through the heat exchanger and discharges to the sewer. It is assumed that the temperature of the water leaving the exchanger is 20 F above the incoming makeup water or 90 F.

Heat of liquid at 5 psig = 196 Btu per lb
Heat of liquid at 90 F = 58 Btu per lb
Heat recovery = 138 Btu per lb

Savings from heat exchanger = 128,000 lb × 0.839 × 138 Btu per lb = 14,820,000 Btu
Total heat savings = 23,030,000 Btu + 14,820,000 Btu = 37,850,000 Btu
Then at a boiler efficiency of 77 percent

$$\text{Oil Savings} = \frac{37{,}850{,}000 \text{ Btu}}{18{,}000 \text{ Btu per lb oil} \times 0.77} = 2730 \text{ lb oil}$$

$$\text{Daily Savings} = \frac{2730 \text{ lb oil}}{7.5 \text{ lb per gal}} = 364 \text{ gal at } 6¢ \text{ per gal} = \$21.84$$

covery equipment is of value only when the low pressure steam or heat recovered from the blowdown water can be utilized for increasing the feedwater temperature. If an excess supply of exhaust or low pressure steam is already available, there would be no savings and installation of heat recovery equipment would not be justified.

Other applications of continuous blowdown water and methods of recovering the heat from this water also are practiced. Under certain conditions, there are advantages in recirculating blowdown water to hot process softeners. In other instances, a small amount of the blowdown water can be returned to the feedwater heater for the purpose of elevating the feedwater pH value. This decreases the possibility of corrosion in the feed lines.

Blowdown Equipment

Manual blowdown equipment is considered a part of the boiler and is installed along with the unit. Such facilities generally consist of a take off line, a quick opening valve, and a shutoff valve. The take off line always is located in the lowest part of the boiler to permit proper draining of the unit and because it is anticipated the greatest concentration of sludge will form at this point.

Water tube boilers generally have several blowoff connections, with one or more being installed under the mud drum and the others at various headers. Blowdown connections on the headers are principally for removing suspended solids which may accumulate at these sections of the boiler and impede circulation. Usually, the manufacturer will stipulate certain restrictions in the blowdown of these water wall headers, and in all instances, these recommendations must be followed.

Deconcentrators

Some plants find the application of a deconcentrator in the blowdown system is advantageous. Essentially, a deconcentrator is a cylindrical tank with special baffling which effects settling of the suspended solids and produces a clarified water that can be returned to the boiler. Blowdown from the deconcentrator contains a higher percentage of suspended solids than the normal boiler blowdown, but the dissolved solids content and alkalinity are not affected. Theoretically, using deconcentrators should be of value in plants where excessive suspended solids content or sludge develops. In actual plant practice, however, they can be recommended only on rare occasions since installation of softening equipment can be justified quite readily for most conditions of this type.

Surface Blowdown

Surface blowdown is the term generally applied to systems where the take off line is located slightly below the working water level. The purpose of this arrangement is to skim sediment and oil from the surface of the water, and frequently the inlet end of the take off line may be equipped with a funnel or similar device to make the installation more effective. A further refinement of this idea involves the application of a floating trough which is designed to remove water at a point close to the boiling surface regardless of any variations in water level in the boiler. Skimming devices, in general, have not found wide application in stationary plants, but are fairly common in marine practice.

Continuous blowdown facilities, including heat recovery equipment, usually are considered boiler auxiliaries although some manufacturers now install the internal collection pipe or at least make provision for

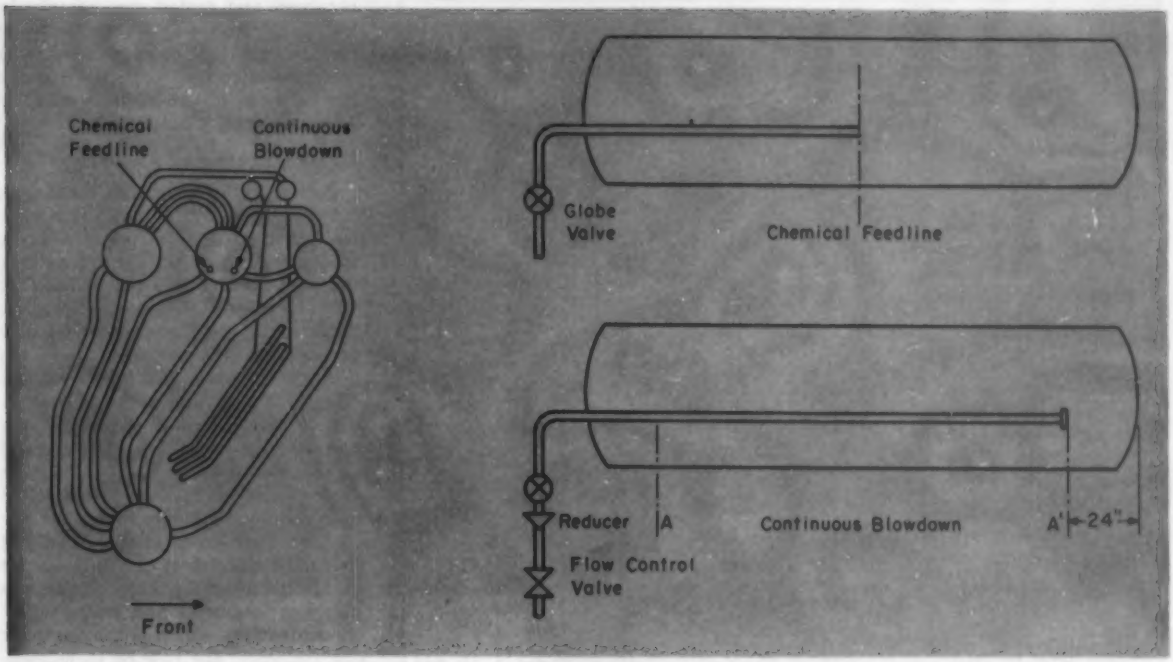


Fig. 3—Typical arrangement of the continuous blowdown take off and chemical feed lines for a four drum steam generator.

it. The exact location of the take off line within the boiler depends mainly upon the water circulation circuits which are involved, as the continuous blowdown system should assure the removal of the most concentrated water from the boiler. Furthermore, short-circuiting of boiler feedwater or chemical feed solution into the take off line must be avoided to assure proper results.

Figs. 3 and 4 illustrate the methods of installation for two typical boiler designs. Generally, the take off line is located approximately two inches below low water level, although in certain boilers it may be located close to the bottom of the drum at a point where the most concentrated water forms. Of course, the size of the lines and control valve depends upon the feedwater characteristics, the quantity of blowdown required, and the boiler rating.

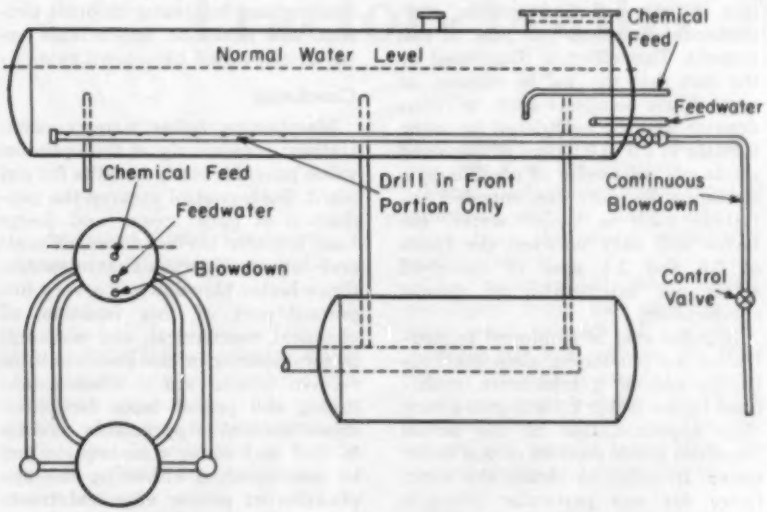


Fig. 4—Feedwater, continuous blowdown, and chemical lines for two drum unit.

Blowdown Control

While the blowdown must prevent the boiler water concentrations from exceeding certain limits, it is equally important to avoid excessive blowdown because of the heat units that are wasted as well as the additional chemical treatment which is required to react with the increased feedwater volume. Therefore, a system of control must be established not only to maintain blowdown within determined limits but also to assure economy of operation. To illustrate, Table 2 shows the amount of heat saved when assuming a reduction in the rate of blowdown from 6 percent to 2.5 percent.

Control Tests

Maintaining an economical blowdown rate, however, requires the performance of suitable boiler water tests which will provide a constant check on concentrations developing in the boiler water. Regardless of the factor limiting the boiler water concentrations, control usually is based on the content of total solids (determined gravimetrically), dissolved solids (measured by specific conductance), chloride, sulfate, silica, or alkalinity in the boiler water or any combination of these tests.

While determinations of the total

TABLE 2 — CALCULATIONS FOR DETERMINING POTENTIAL SAVINGS WITH REDUCTION IN BLOWDOWN PERCENTAGE

Basis - - - 1 day

Evaporation	=	2,000,000 lb steam
Boiler pressure	=	175 psig
Feedwater temperature	=	200 F (live steam used)
Makeup water temperature	=	70 F
Present rate of blowdown	=	6.0 percent
Optimum rate of blowdown	=	2.5 percent
Boiler efficiency	=	77 percent
Fuel	=	Oil, 18,000 Btu per lb at 6¢ per gal
Feedwater	=	Steam plus blowdown
Feedwater at 6 percent blowdown	=	2,128,000 lb
Feedwater at 2.5 percent blowdown	=	2,051,000 lb
Savings in boiler feedwater	=	77,000 lb
Heat of liquid at boiler pressure	=	350.8 Btu per lb
Heat of liquid at 70 F	=	38.0 Btu per lb
Heat savings	=	312.8 Btu per lb

Total heat savings = 77,000 lb × 312.8 Btu per lb = 24,086,000 Btu

$$\text{Oil savings} = \frac{24{,}086{,}000 \text{ Btu}}{18{,}000 \text{ Btu per lb oil} \times 0.77} = 1738 \text{ lb oil}$$

$$\text{Daily savings} = \frac{1738 \text{ lb oil}}{7.5 \text{ lb per gal}} = 232 \text{ gal at 6¢ per gal} = \$13.92$$

solids content of the boiler water provide an excellent index for controlling blowdown and usually are applicable from a technical standpoint, such analyses are rarely employed because they require too much time and are too difficult for a routine control. Furthermore, there are objections to the use of the total solids test for calculating the rate of blowdown. A comparison of the total solids content of the boiler water with the total solids content of the feedwater will not necessarily provide an accurate measure of the concentration that has taken place within the unit because the boiler water samples do not show a representative suspended solids content or the effects of internal treatment, breakdown of bicarbonates and carbonates, and liberation of carbon dioxide gas.

Specific Conductance

Determinations of the specific conductance of a boiler water will provide an accurate measure of the dissolved solids content and usually can be applied to blowdown control with considerable advantage. However, calculation of the rate of blowdown on the basis of the relative specific conductance of the feedwater and boiler water is not technically correct. Not only will specific conductance be affected by loss of carbon dioxide with the steam and the solids introduced by internal chemical treatment, but the respective values for dilute solutions such as feedwater and concentrated solutions such as boiler water cannot be compared directly.

Specific conductance is caused by ionization of the various salts present in the sample. In dilute solutions, ionization increases and greater specific conductance results. In more concentrated solutions, ionization is repressed and specific conductance decreases per part of salt present. This effect is illustrated by the fact that the solids content of very dilute solutions such as condensate may be calculated by using a factor of 0.5 to 0.6 ppm of dissolved solids per micromho of specific conductance. In more concentrated solutions, such as boiler water, the factor will vary between the limits of 0.6 and 1.1 ppm of dissolved solids per micromho of specific conductance.

If gallic acid is employed to neutralize the phenolphthalein alkalinity, the specific conductance multiplied by the factor 1.0 will give a very close approximation of the actual dissolved solids content of the boiler water. In order to obtain the exact factor for any particular plant, a suitable number of representative samples of boiler water should be obtained and tested gravimetrically for dissolved solids content. These results then can be correlated with the neutralized or corrected specific conductance of the samples and the average factor calculated.

Sulfate, Silica, and Alkalinity

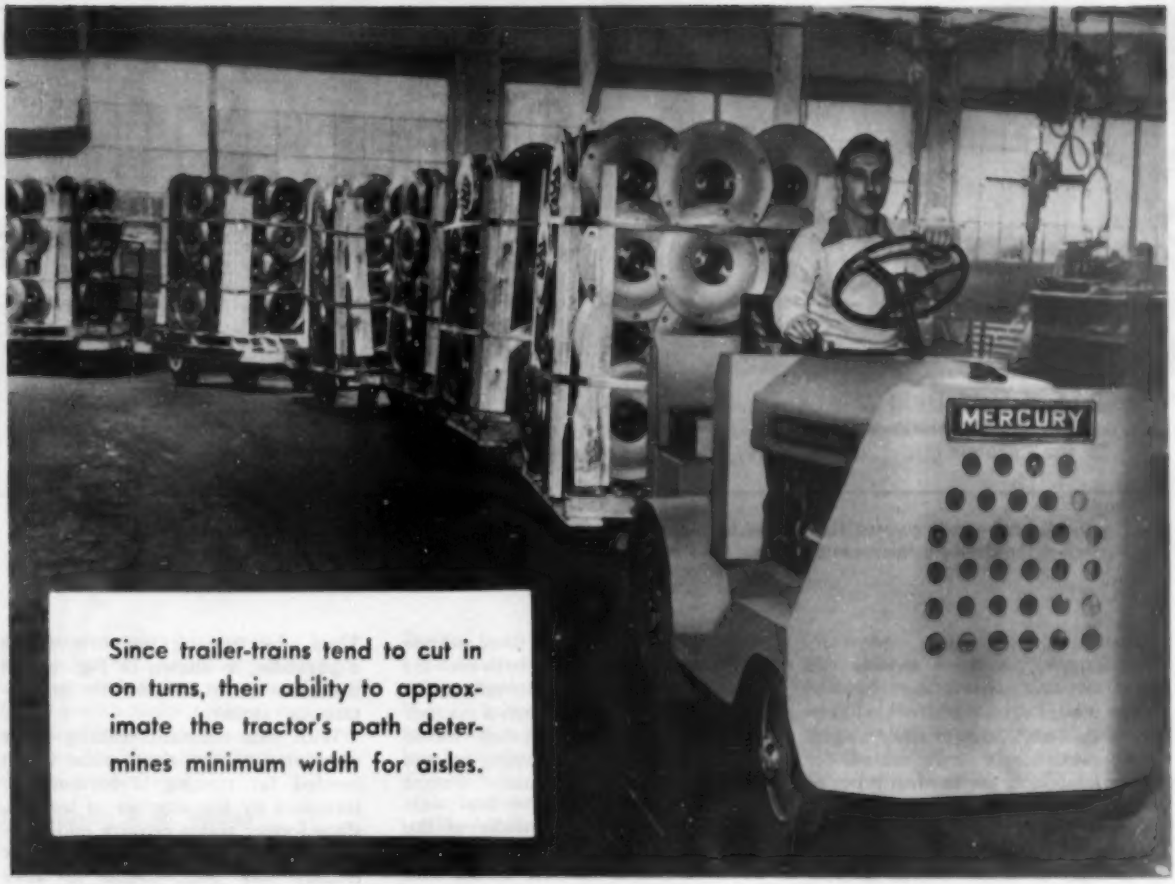
Sulfate, silica, and alkalinity content can be used for blowdown control under those circumstances where they are factors which limit the boiler water concentrations that may be safely tolerated. Usually, however, these determinations are not suitable for calculating the blowdown rate since both sulfate and silica may be removed from solution as scale. The use of sodium sulfite will increase the sulfate content of the boiler water, and alkalinity generally is affected by either variable softener balances or by the internal treatment employed. All these conditions prevent accurate determination of the relationship between feedwater and boiler water concentrations which is the basis for calculation of the rate of blowdown.

Chloride Tests

Chloride determinations can be used not only for blowdown control but also for calculating blowdown rate provided the chloride concentration of the feedwater is sufficient to permit accurate measurement. Since chloride is not subject to precipitation in the boiler water, percent blowdown can be calculated directly by dividing the concentration in the feedwater by the concentration in the boiler water. The chloride test is unsuitable for this calculation only in those cases where the feedwater chloride is quite low, say in the range of 0.5 to 1.0 ppm. In this range a slight analytical error in determining feedwater chloride content will cause an appreciable error in calculated blowdown rate.

Conclusion

Maintaining boiler water concentrations consistently at the optimum value provides many benefits for any plant. Such control assures the production of pure steam and keeps heat transfer surfaces free of scale and other objectionable deposits. Since boiler blowdown is a very important part of this function, all chemical, mechanical, and economic factors bearing on the problem must receive careful study when establishing the proper basis for blowdown control. Appreciable savings in fuel and water consumption can be accomplished either by the application of proper chemical treatment methods or by the installation of heat recovery equipment.



Since trailer-trains tend to cut in on turns, their ability to approximate the tractor's path determines minimum width for aisles.

How Trailability Determines Tractor-Trailer Aisle Widths

JOHN J. SICHMAN
Assistant Chief Engineer
Mercury Manufacturing Co.

AISLE WIDTH is an important consideration when selecting tractor-trailer systems. The trailer train's ability to approximate the initial path of a tractor is the determining factor in establishing the minimum aisle width required for turns. This trailability is dependent upon the position of the trailer's fixed wheels relative to the articulate points of the couplers.

Basically, there are three types of industrial trailers. Each gets its name from the wheel suspension used to steer it.

The caster-wheel steer trailer, developed from the caster-wheel hand truck, consists of a platform mounted on four wheels. Its front wheels are mounted in swivel caster assemblies, and the rear wheels are mounted on a fixed axle. The rear wheels are usually larger than the caster wheels and carry the bulk of the load.

This type of trailer turns by swiveling on its front caster wheels and pivoting about a vertical axis whose location changes from a position midway between the fixed rear wheels, as when the trailer is turned by hand, to a position along the centerline of the fixed axle where it is coincident with an instantaneous center, as when it tracks at a minimum turning radius of the train as shown in Fig. 1.

Caster-wheel steer trailers are moved easily by hand and can be turned in very confined spaces. In addition, a train made up of these trailers will trail accurately. These qualifications make them very suitable for all-purpose work.

The second kind of trailer, the

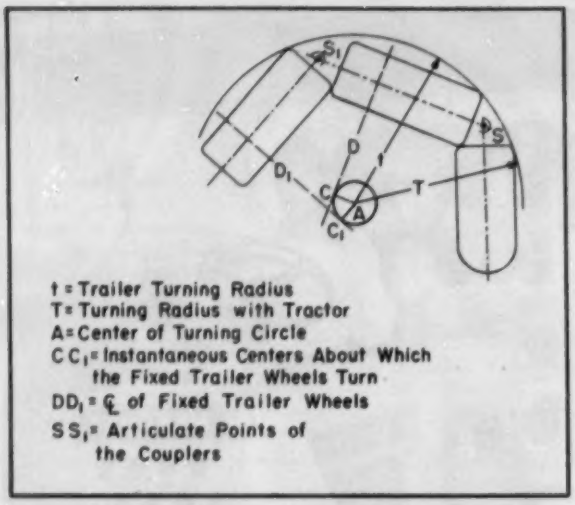


Fig. 1—Caster-wheel trailers turn on instantaneous centers determined by the location of the fixed axle.

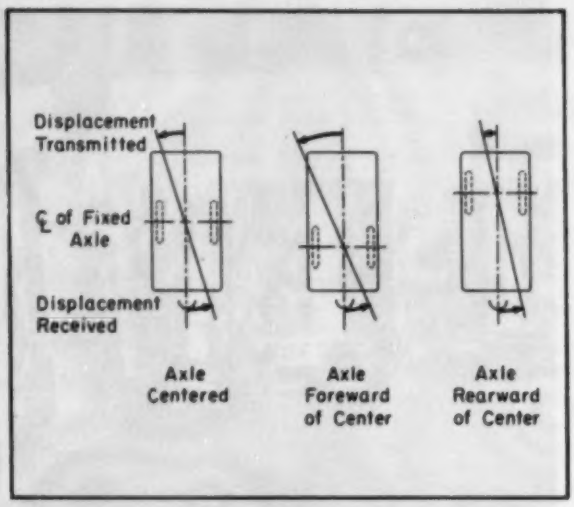


Fig. 2—Drawing shows how location of the fixed axle influences the magnitude of trailer whipping.

fifth-wheel steer type, generally has four equal-sized wheels. Its front steering wheels are attached to the platform by a fifth wheel similar to that on a farm or dray wagon. It is particularly well suited for heavy loads and the hardest types of service.

However, a train of fifth-wheel trailers will not trail as accurately as a train of caster-wheel trailers, and is not reversible. In addition, these trailers are hard to turn by hand in confined areas. They are difficult to back up with a tractor because double pivot points are involved. A special application of the fifth-wheel steering mechanism to both ends of the trailer, known as a double fifth-wheel, makes this type of trailer reversible.

The third type, the four-wheel steer trailer, has all four wheels arranged to steer simultaneously. This type of trailer is often a further adaptation of a double fifth-wheel type, namely, two fifth-wheel steering assemblies connected by cross bars. In some designs four wheel steering is accomplished through use of knuckle mounted wheels.

Four-wheel steer trailers are excellent where accurate trailing is absolutely essential. They are extremely difficult to maneuver by hand, however, and require considerable space in which to turn. As a result, they are not often used.

Factors Affecting Trailability

An analysis of the steering action of a caster-wheel trailer, as a typical consideration, will illustrate the relationship between wheel position and trailability. If the fixed wheels were located midway between the articulate points of the couplers, the trailer would move in such a manner that every articulate point would follow the path of the turning arc and would always be equally distant from the theoretical vertical axis running through the middle of the fixed axle. In theory, a trailer constructed in this manner would trail perfectly. In practice, however, such an arrangement is susceptible to whipping actions caused by the normal side motions of the tractor.

The tendency to whip can be easily understood if the trailer is considered as a lever pivoted on the centerline of the fixed axle. As shown in Fig. 2, the displacement of the trailer's front coupler, caused by side motion of the tractor, would be transmitted to the next trailer in equal magnitude if the pivot point were located midway between the front and rear couplers.

Moving the fixed wheels forward would tend to magnify the side motion transmitted to the next trailer, while moving the fixed wheels rearward diminishes it.

Unfortunately, any gain in the trailer's ability to counteract whipping is accomplished at the expense of trailability. Because the centerline of the fixed axle no longer passes through the center point of the turning arc, a train made up of trailers whose fixed axles are located to the rear of the center of the platform will not follow the curve accurately. The trailers cut in a trifle as they trail and have separate paths and separate pivot points. Thus, the turning path resembles a parabola, as shown in Fig. 4, and the pivot point is now an instantaneous center.

With this constant trailing error or deviation, the extra aisle width needed for turning is further determined by the number of trailers, since longer trains require additional width. A train of five to six trailers has been found to offer optimum load-carrying capacities without requiring uneconomically large aisle widths. Also, aisles are not seriously tied up as they would be if more trailers were used.

Location of Wheels

Experience has shown that reasonably accurate trailing without whipping can be achieved if the fixed wheels are located approximately one-third of the deck length from the rear of the trailer. The location of the free-swiveling casters has no bearing on trailing of the vehicle and little or no effect on whipping. However, their location does affect the gradability and stability of the trailer. If the king pins of the casters are located about one-sixth of the deck length from the front of the trailer, gradability and stability will be good.

With the fixed and caster wheels in the positions indicated, the rear wheels will carry approximately two-thirds of the load. This is one of the reasons why the caster wheels are smaller than the fixed wheels.

The one-third and one-sixth deck length proportions are easily maintained on trailers up to nine feet in length. On longer trailers, these

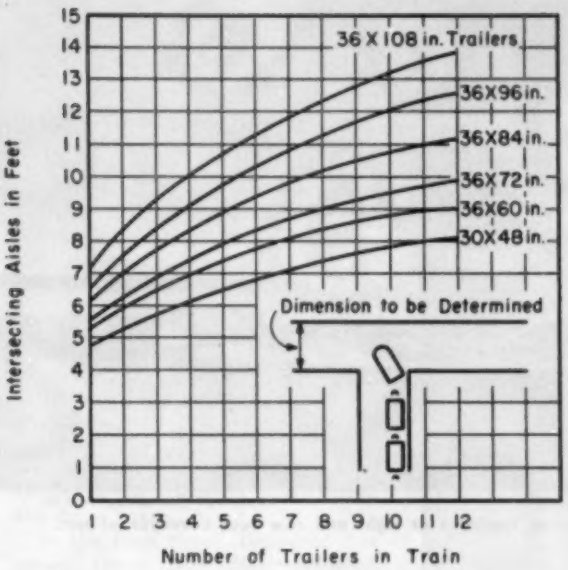

36 X 108 in. Trailers
36X96 in.
36X84 in.
36X72 in.
36X60 in.
30X48 in.
Dimension to be Determined
Intersecting Aisles in Feet
Number of Trailers in Train
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Fig. 3—Chart for determining minimum intersecting aisle widths needed for varying trailer-train sizes.

Train of four-wheel steer trailers. Cross bars connecting the two fifth wheel assemblies can be seen.

proportions must be varied to favor grade clearance and to avoid highly-concentrated frame stresses. Interference with stake pockets and special trailer applications are other reasons for deviating from the optimum proportions.

Determining Aisle Widths

Because industrial trailers are designed to effect a compromise between trailability and whipping, their turning points — instantaneous centers with constantly-changing paths — are difficult to lay out on paper. Tests run on actual equipment, or scale models, offer the quickest, easiest, and most accurate methods for determining tracking paths and aisle-width dimensions. Typical test results, based on a 41 x 72 in. three-wheel, short-turning radius tractor towing a train of six, 36 x 72 in. caster-wheel trailers are tabulated in Figs. 4 and 5. The tabulated values provide for sufficient clearance.

Beyond a certain number of trailers, aisle-width dimensions remain the same for all practical purposes. This results from the fact that the maximum turning angle of the trailer couplers is reached after a certain number of trailer turns and the remaining vehicles in the train therefore must follow a relatively fixed path.

Curves compiled by manufacturers are useful in determining aisle-width dimensions when trailer sizes and wheel suspension are known. The curves in Fig. 3 give recommended minimum intersecting aisle-width dimensions for trains of caster-wheel trailers, equipped with safety self-couplers, whose fixed axles are one-third of the deck length from the rear of each trailer.

As an example, a train of eight 36 x 96 in. trailers would require about 11½ ft aisle widths. One foot should be added to this figure to allow proper clearance for this train. The recommended dimension, therefore, would be 12½ ft. To find the required aisle dimension for trailer widths not shown, find intersecting aisles for trailers of the same length and add or subtract the difference in the widths of the trailers.

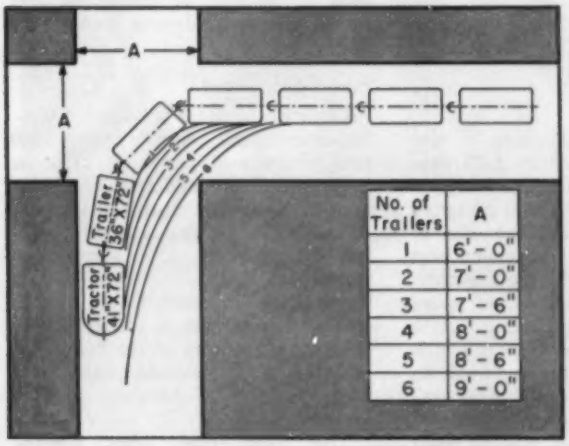


Fig. 4—Paths traversed by caster-wheel trailers when turning. Table lists required aisle widths.

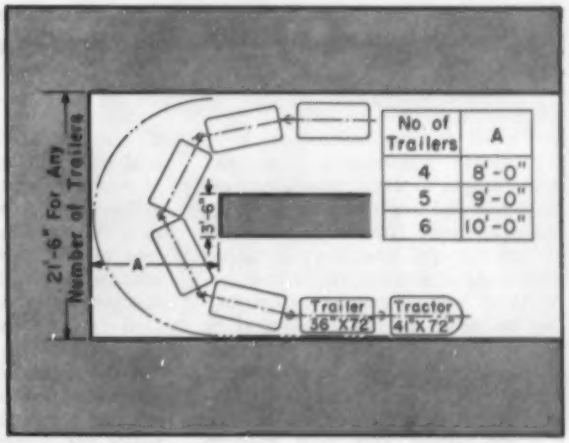


Fig. 5—Minimum distance from wall required by caster-wheel steer trailers making a 180 degree turn.

Pittsburgh Consolidation Coal Co.

Exterior view of Georgetown Preparation Plant showing loading facilities at right and raw coal conveyor at left.

Electric Drives Control Coal Feed to Dryers

Screw-feed conveyors, assisted by all-electric, adjustable-speed drives, carry fine coal from storage bins to flash dryers in preparation process at Hanna's ultra-modern Georgetown Plant.

C. E. HUGUS
Supervisor of Mining Applications
Reliance Electric & Engineering Company

TOPSIDE mining techniques have shown tremendous progress with respect to development of new machines and improvement of existing equipment. Numerous examples of how the coal industry is taking advantage of mechanized techniques in their above ground operations can be seen in the ultra-modern Georgetown Preparation Plant of Hanna Coal Company, a division of Pittsburgh Consolidation Coal Company. Built near Cadiz, Ohio in 1951, it is the largest and most modern commercial coal preparation plant of its type in the world. This plant handles as much as 1500 tons of raw coal per hour to produce 1275 tons of washed, dried, and sized coal.

The Georgetown Plant is designed to process each particular size of coal in the type of equipment best adapted to the job. Three separate, independently controlled and operated circuits for processing 0 x ¼ inch, ¼ x 1½ inch, and 1½ x 7 inch coal have been engineered into an integrated, smooth-functioning installation that turns out coal in virtually any commercial size or combination of sizes desired.

Of particular interest in coal preparation plants, from the electrical viewpoint, is the steadily increasing application of adjustable-speed drives—especially for various types of conveyor equipment. In the Georgetown plant, the all-electric drives for operating four, 11-foot screw-feed conveyors in the 0 x ¼ inch circuit play an important part in the cleaning, drying, and sizing of the coal.

Fine Coal Circuit

Capacity of the 0 x ¼ inch washing-and-drying circuit totals 300 tons of raw coal per hour. The ¼ inch size is screened from the run-of-mine coal by flushing through secondary sizing screens with water, using up to 4000 gpm when necessary. It is discharged into a raw coal settling tank, where it sinks to the bottom and is picked up by six drag conveyors. After being dewatered, it is divided into equal parts to feed 31 Diester cleaning units.

The clean coal, after passing through a settling tank which reduces excess water by gravitation, is

fed into six Reineveld dryers. It enters the dryers at the top and is picked up by drums spinning at 750 rpm. The centrifugal force throws the water through the coal and through a perforated basket, and the coal drops to the bottom. Moisture in the coal is reduced from 25 to about 8 percent.

The coal is then collected in four 100-ton bins. Screw-feed conveyors, installed at the bottom of the bins, pick up the coal and convey it to four Raymond flash dryers which further reduce moisture content. In order to maintain a uniform product, the rate of feed into the flash dryers is varied to meet temperature conditions. Adjustable-speed gearmotor drives, used on the screw-feed conveyors, permit the operator to adjust the conveyor speed from the dryer control panel.

In the flash dryer, tempered flue gases (from two Bigelow-Liptak thin-wall furnaces, fired by Firite traveling-grate spreader stokers) carry the coal upward through 30-foot drying columns at a rate of approximately 3000 fpm. The water in the coal is instantly evaporated.

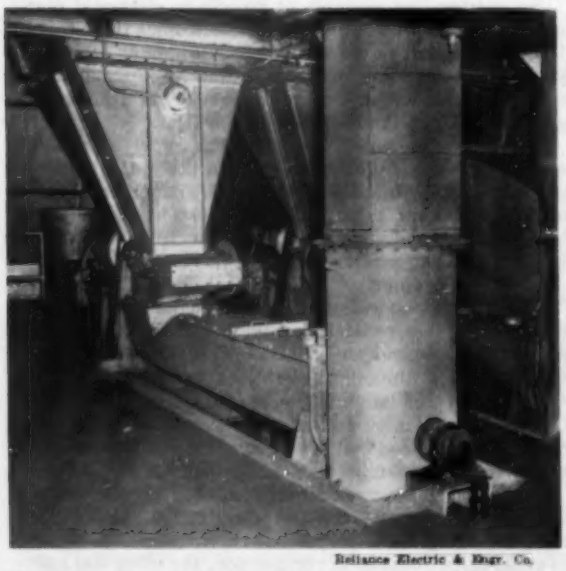
The vapor and coal then enter a cone-shaped "cyclone", and are mixed at high speed. The coal is thrown to the sides and drops onto a conveyor belt leading to a 100-ton blending bin above the loading tracks. The coal leaves the flash dryers with approximately 2½ percent surface moisture—the maximum dryness possible without creating excessive dustiness. Meanwhile, the spent gases move on to wet scrubbers where they are dedusted with water sprays and exhausted to the atmosphere.

Reliance Electric & Engr. Co.

Speed indicators and controls, together with temperature indicators for gas flow to flash dryers, are mounted in this centrally located operator's panel.

All-Electric Drives

The application of all-electric, integrated gearmotor drives to power the conveyors which feed coal to the flash dryers exemplifies a trend in electrical equipment toward "packaged power" design. The "power packages" are Reliance Electric & Engineering Company V-S drives having a speed range of 190 to 20 rpm. Each drive consists of three basic components: a 7½ hp adjustable-speed gearmotor, a control unit,



Reliance Electric & Engr. Co.

View shows one of the screw-feed conveyors used to feed fine coal from storage bins into columns of flash dryers.

Reliance Electric & Engr. Co.

Adjustable-speed gearmotors for screw-feed conveyors are shown in background. Control units are in foreground.

and a centrally located operator's control station.

The control units are connected to the plant's incoming a-c power distribution line, and contain all the elements required to provide the desired operating functions such as speed control, starting, and stopping. They are completely enclosed, and incorporate air filters to keep out the dirt and abrasive dust present in the air. The frequency of cleaning is thereby reduced, and windings operate at lower temperatures.

Maintenance costs on the control units have been exceedingly low. Operational failures also have been low, particularly when the severe duty to which these drives have been put over the past two years is taken into account. This outstanding performance may be credited not only to the equipment itself, but also to the preventative maintenance program rigorously practiced by Hanna's engineers.

The control units are factory-assembled and pre-wired, a factor which expedited their installation and substantially reduced the amount of engineering required. The only wiring required at the installation site consisted of inter-connecting the factory-wired control units, operator's stations, and adjustable-speed gearmotors.

The control stations are conveniently mounted in a single, centralized location. Speed indicators for the four drives are panel-mounted immediately below temperature indicators for the gas flow from the furnaces to the flash dryers. Rheostat control knobs for the drives are mounted below the console section.

Speed Control

Accurate control of speed was an important factor favoring selection of the all-electric, integrated gearmotor type of drive. Drying is hampered if the coal feed to the dryers becomes excessive. Too small a flow, on the other hand, may lead to excessive burning. Feed rates vary from 10 to 70 tons per hour. The speeds selected depend upon the blending schedules followed and are predetermined on the basis of experimentation combined with previous operating experience.

From the operational standpoint, flexibility ranks as the dominant keynote of the drive. The adjustable-speed feature permits the flow of coal to be varied during start-up of the furnace. As the temperature increases, quantity of coal may be increased correspondingly. Moreover, quantity of dryer feed is easily adjusted to compensate for changes in moisture content of the coal.

The adjustable-speed feature of the drive also provides a relatively simple means for adjusting the production schedule of the dryers to permit continuous 24-hour operation without shutting down the furnaces for lean periods of coal input.

By providing the flexibility needed to operate the flash dryers, and by providing accurate control of speed on a uniform, consistently repetitive basis, the all-electric drives have constituted a vital adjunct to delivery of a uniform and controlled product in this plant.

Continued Growth in Electrical Manufacturing is Predicted

OVER 200 LEADERS of the electrical manufacturing industry recently met with 600 teachers of social studies from throughout the nation at the third session of The Industrial Council, held at Rensselaer Polytechnic Institute. The objective of this meeting was to achieve a wider understanding between the electrical manufacturing industry and the representatives of education.

Out of the panel discussions and speeches of the two-day session came one major agreement on the part of the industry's spokesmen. All agreed that, although the electrical manufacturing industry is getting along in years as compared to some industries, its horizons are greater than ever.

The use of electricity in the United States has doubled every ten years since 1910, and this goal will again be attained by 1960, predicted A. W. Robertson, finance chairman of Westinghouse Electric Corp. The amazing growth of the electrical industries is largely based upon honesty and reliability, he said.

In discussing the tremendous growth of the electrical industries, R. J. Cordiner, president of General Electric Co., stated that the private electric utility industry alone is spending $20 billion in the 10 post-war years. The average size of large steam turbine purchases has increased from 50,000 to 125,000 kw. Units as large as 250,000 kw are currently being built, and we have the know-how to build units twice as large whenever they are economically justified.

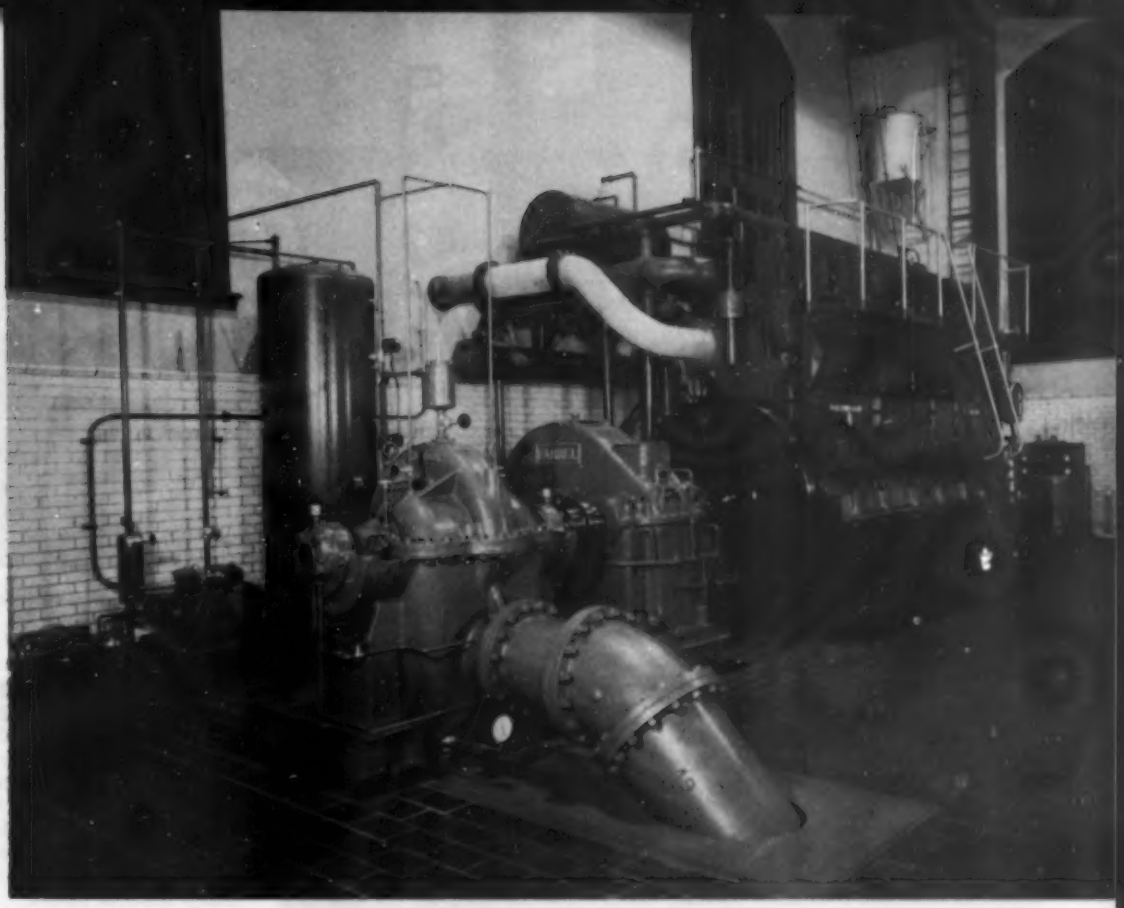
Experts in power generation, transmission, and distribution predict that in the next few decades, such big blocks of power will be needed that the utilities may well need individual turbine ratings of a million kilowatts or more.

An outstanding example of growth in electrical manufacturing is found in the infant electronics industry. In 1939, production of all electronic equipment amounted to $230 million. The industry is now producing at the rate of $4.5 billion, and some experts predict that it will grow to a $20 billion industry by the 1960's.

The electrical manufacturing industry as a whole is expected to account for 6 percent of the entire national production in 1963, as compared with 4.1 percent in 1952 and only 1.75 in 1925. Industry must be prepared to build, install, and service as much electrical equipment in the next 10 years as it has in the last 75 years, according to Cordiner.

"Since the electrical equipment industry owes its very existence to the research and engineering achievements of its founders and early pioneers, it is not surprising that it has continued through the years to put great emphasis in fundamental research and development," Cordiner said. It is encouraging to note that electrical manufacturing leads all manufacturing industries in investment for research and development.

According to government studies, the national average investment in research and development among all manufacturing industries amounts to about 2 percent of gross sales volume. In comparison, the electrical manufacturing industry's average research expenditure is more than 6 percent of sales volume.



A slow speed diesel engine can be used to drive a higher speed centrifugal pump through step-up gears.

Centrifugal Pump Drives

IGOR J. KARASSIK and ROY CARTER
Worthington Corporation

ALMOST ALL FORMS of prime movers and sources of power have been used for centrifugal pump drives. The most common present day drives are electric motors. Steam turbines, either direct connected or geared, are also frequently applied. Diesel engines, during the last few years, have been gaining in popularity.

Size of Driver

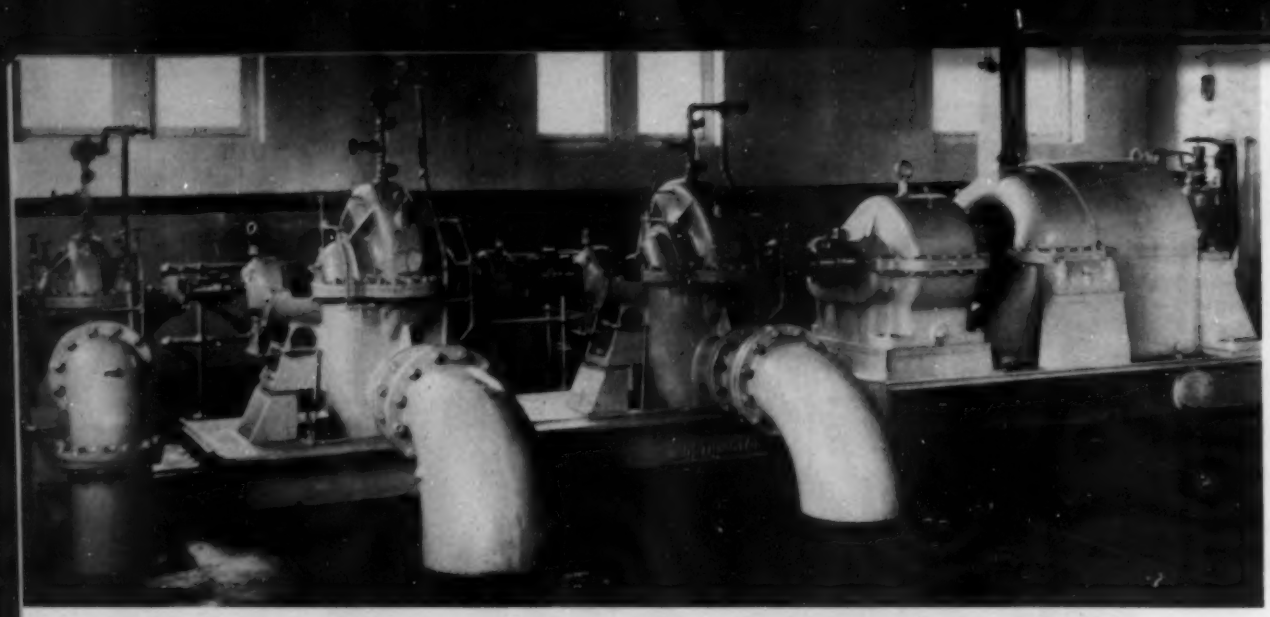
The power required to drive a centrifugal pump from shut-off to maximum capacity varies mainly with its specific-speed and, to a lesser degree, with its individual design. In the low specific-speed types, the power requirements are minimum at shut-off and increase to a maximum at or near maximum capacity. Operation at pressure heads below normal will result in increased power requirement. An overload may be imposed on the driver if the driver has been selected solely on the basis of the power required at normal or design conditions.

On the other hand, the high specific-speed types have the reverse power requirement. A reduction in head results in a reduction in the power required. However, in a high specific-speed pump, care has to be taken to select a driver size suited to driving the pump against the highest possible operating head.

Steam Turbines

In a steam turbine having a constant speed governor, the governor adjusts the position of the steam inlet valve until the torque developed by the turbine at governed speed equals the torque required by the pump. With wide open throttle and constant steam conditions, the torque that can be developed by the turbine is fixed. Should the pump demand more torque, the turbine will slow down below its governed speed until its developed torque matches the demand torque. Because operation at reduced speed will not damage the turbine, there is never any danger of overloading.

When friction and wear cause increased leakage through the wearing rings in turbine driven units,



Series of large capacity pumping units driven by a higher speed condensing steam turbine through reduction gearing.

the pump capacity will be reduced. Generally, smaller pumps are not checked as carefully as large pumps, and the leakage in the smaller units can become more pronounced before the leakage joint is restored to its original clearance. Therefore, in smaller steam turbine driven units, the turbines are generally selected for some excess power (roughly 5 percent over maximum expected loading), while in large units, turbines are selected for a rating equal to or just slightly in excess of the maximum loading.

Internal Combustion Engines

Most automotive type engines are of the high speed type and have a limited life when used for continuous operation. Medium speed type engines have a longer life. The low speed type of engines have a very long life with a minimum of maintenance required.

Internal combustion engines rated on the basis of a constant load will also carry an overload. Engines rated on the basis of maximum developed power can be overloaded but such operation, if other than momentary, will generally result in mechanical failure.

Squirrel Cage Motors

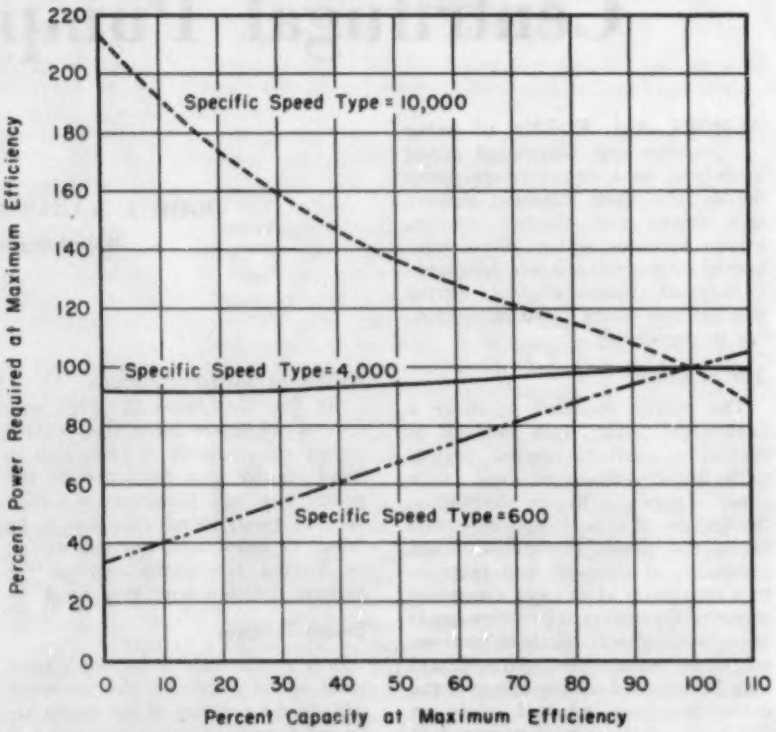
The squirrel cage motor is the simplest type of electric motor and is the most commonly used for centrifugal pump drives. It has a wound primary (stator) winding and a squirrel cage secondary (rotor) winding which takes power from the primary winding by transformer action. No electrical connection to the rotor is required. Mechanical construction permitting, a squirrel cage motor can run in either direction and is reversed by reversing any two leads of a three phase motor or the two leads of single phase or two phase motors.

Squirrel cage motors are made in a number of types electrically. The common types are:

(1) Normal torque, normal starting current (NEMA Class A)
(2) Normal torque, low starting current (NEMA Class B)
(3) High starting torque, low starting current (NEMA Class C)
(4) High starting torque, high slip (NEMA Class D)

In addition there are two special types, (a) low torque, normal starting current, and (b) low torque, low starting current. Besides single speed motors, multi-speed motors, category (5), are available from many manufacturers.

Centrifugal pumps do not require the use of a motor having a high



Variation in shape of bhp-capacity characteristics with specific speed.

starting torque so types (3) and (4) do not find a field of application for centrifugal pump drives.

Multi-speed motors are offered in the constant horsepower type and in both the constant torque and variable torque types. As the power in a centrifugal pump varies as the cube of the speed, the torque varies as the square of the speed. The variable torque type of multi-speed motor is therefore most suitable for centrifugal pump drive.

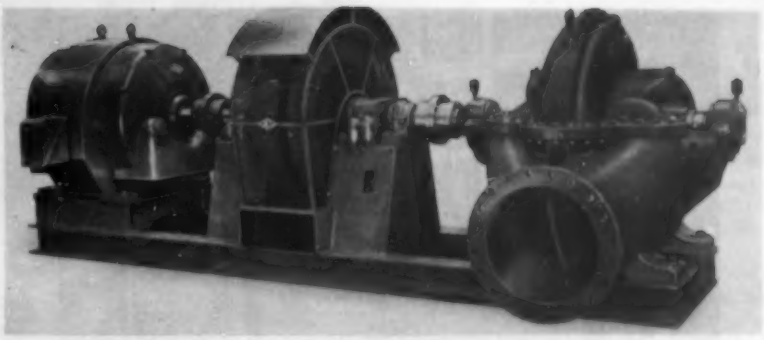
For most centrifugal pump applications constant speed motors are used. The normal torque squirrel cage motors, both of the normal and low starting current types, are the most common. These are the general purpose types in open frame horizontal designs. The normal torque, low starting current types were formerly used primarily when full voltage starting was employed. They were more expensive than the normal torque, normal starting current type. This price differential no longer exists and the motor manufacturers are discontinuing the normal torque, normal starting current type making their standard instead the normal torque, low starting current type.

Slip Ring Motor

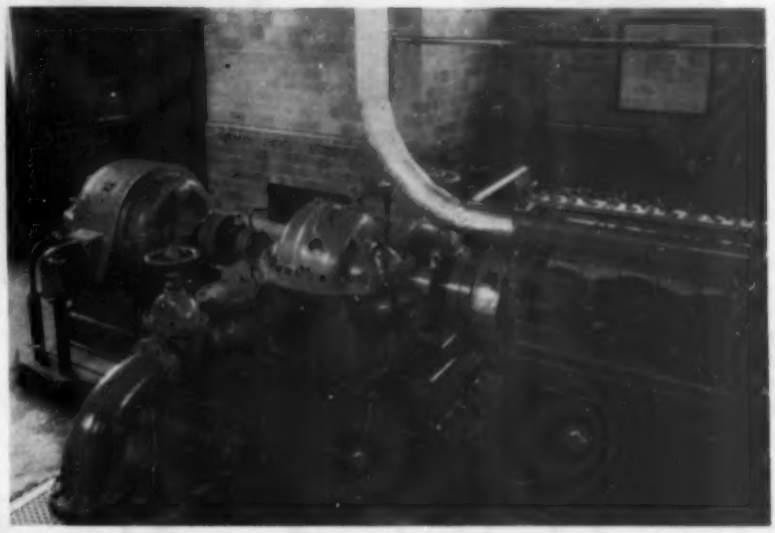
The major field of application of slip ring motors is for installations where variable speed is necessary. The resistors used for speed control must dissipate the heat resulting from the flow of current through them. The commercial form of speed control cuts the resistance into the rotor circuit in steps so the resulting speed change is also in steps. Thus, when fine adjustments of speed are required, it is necessary to obtain a control with a large number of contact points or to use a liquid slip regulator. Where very fine adjustment of speed is needed, the hydraulic and magnetic drives are finding more application.

One of the major advantages of the slip-ring motor lies in its starting characteristics. With proper resistance in the rotor circuit, the current demand throughout the entire starting period can be kept very low. For example, on starting, it can deliver rated torque without drawing more than rated current from the line. This feature makes the motor very desirable if it is to be operated on a limited power supply or if the size of the supply line is limited.

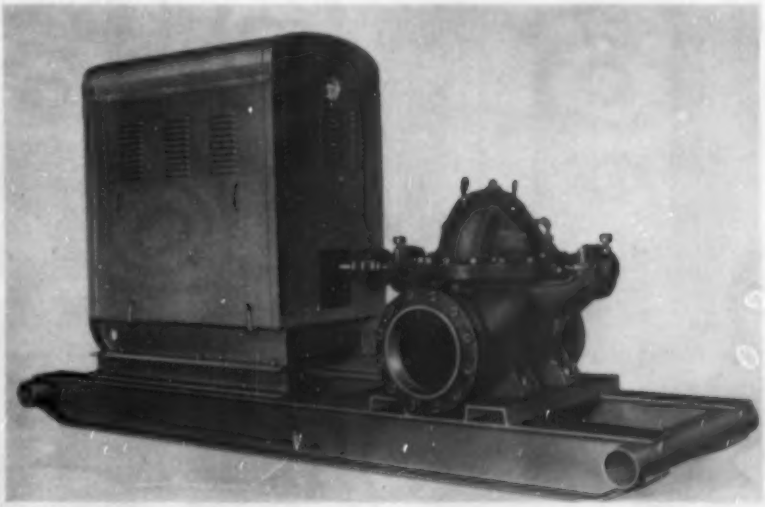
The general purpose type of direct-current motor is not suitable for centrifugal pump drive as the full load speed of such motors may



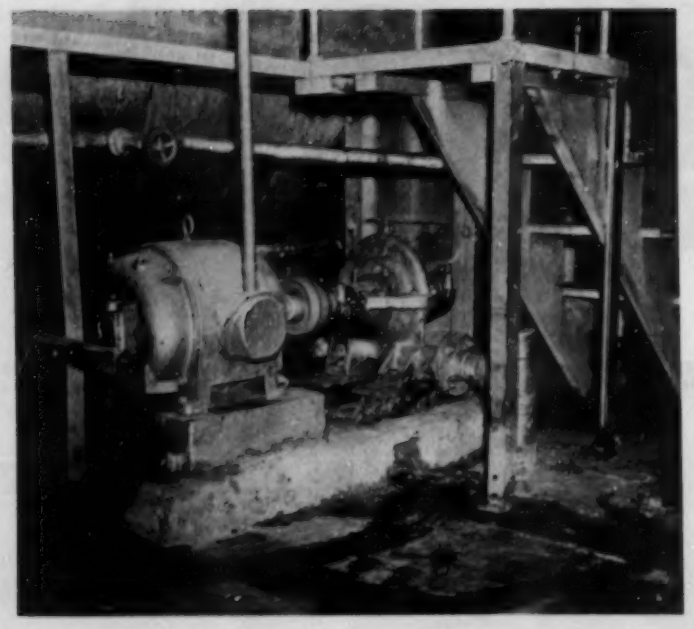
Variable speed magnetic transmission connects constant speed motor to pump. Efficiency of drive is nearly proportional to operating speed and full load speed.



Water works often employ dual drives. This pump is normally electric motor driven. The gasoline engine driver is used in event of power failure.



Gasoline engines are generally preferred as drivers for fire pumps or other applications where mobility of the unit is an important consideration.



Selection of motor enclosure is important when a motor-driven unit is subjected to dripping liquids in a damp and dirty location.

be 5 to 7½ percent above or below their rated speeds. If the actual speed of the motor is below the rated speed, the pump will not operate at its given conditions. If the actual speed of the motor is above its rating, the pump will deliver excess head or capacity with the increased power requirements possibly imposing a dangerous overload on the motor. For centrifugal pump drives, d-c motors must be specially designed. A design should be furnished by the motor manufacturer which will have a full load speed within ± 3 percent of the rated full load speed of the motor.

Single Phase Motors

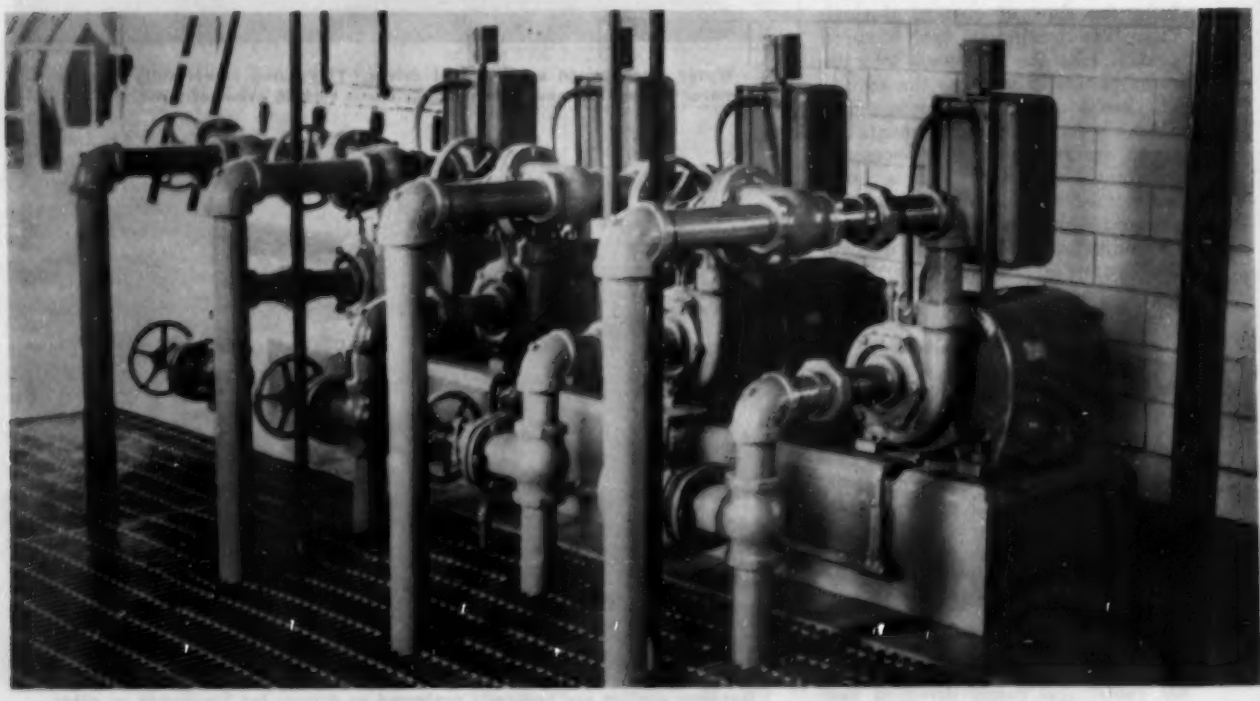
Single phase alternating current motors are available in the split phase, series (universal), repulsion-induction, and capacitor types. Generally, for centrifugal pump drive, either the repulsion-induction or capacitor type is suitable.

Enclosures

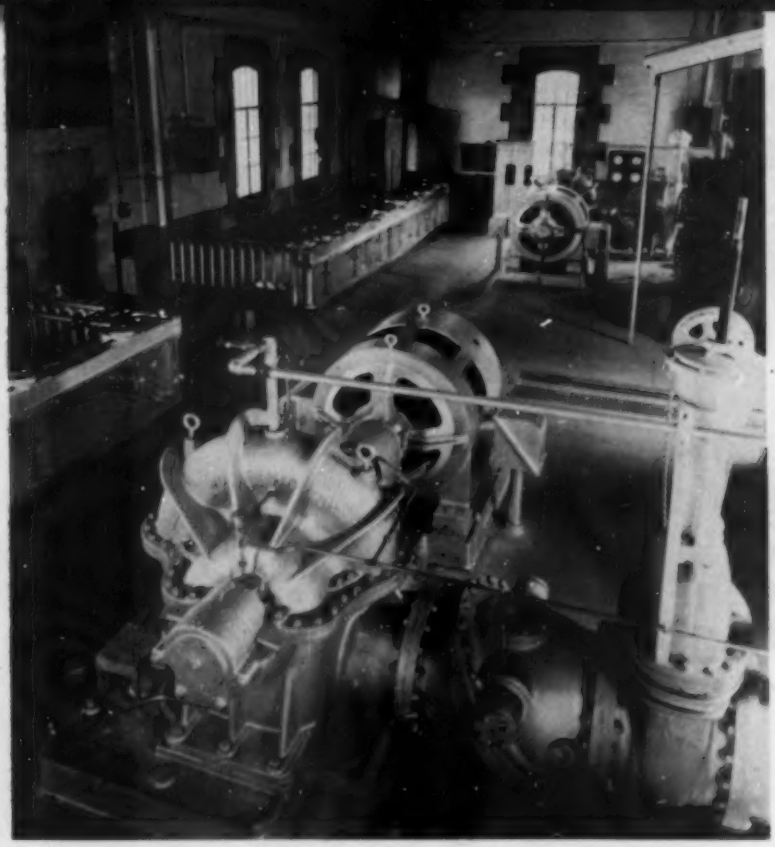
Horizontal motors having open or drip proof frames with standard insulation are satisfactory for most centrifugal pump applications. Except for large horsepower sizes, for which pedestal type sleeve bearings are used, the mechanical construction has anti-friction or sleeve bearings supported by brackets attached to both sides of the frame.

In many applications, the open frame motor is not suitable and a special enclosure is necessary. The frame designs and modifications quite commonly needed are drip-proof, splash-proof, totally enclosed, self-ventilated or fan-cooled.

Motors installed in damp locations on machines which are not fre-



In the smaller range of sizes, direct-coupled motor-mounted centrifugal pumps are finding increasingly wide acceptance.



Municipal water works rely almost entirely on electric motor-driven centrifugal pumps (as shown) to provide reliable round-the-clock pumping service.

quently used can become damp, especially in cold weather, with resulting damage to the motors. Larger motors under these conditions are often protected by installing electric space heater elements which can be turned on when the motor is not in operation keeping the motor warm and dry.

Variable Speed Operation

Since the operating conditions of a centrifugal pump are determined by the intersection of its head capacity curve with the system head curve, the only means available to vary the operating conditions is the alteration of the system head curve by means of throttling, if the pump is operating at constant speed. In many cases it may be more practical, and certainly more economical, to change the intersection point referred to above by varying the operating speed and hence the head capacity curve of the pump.

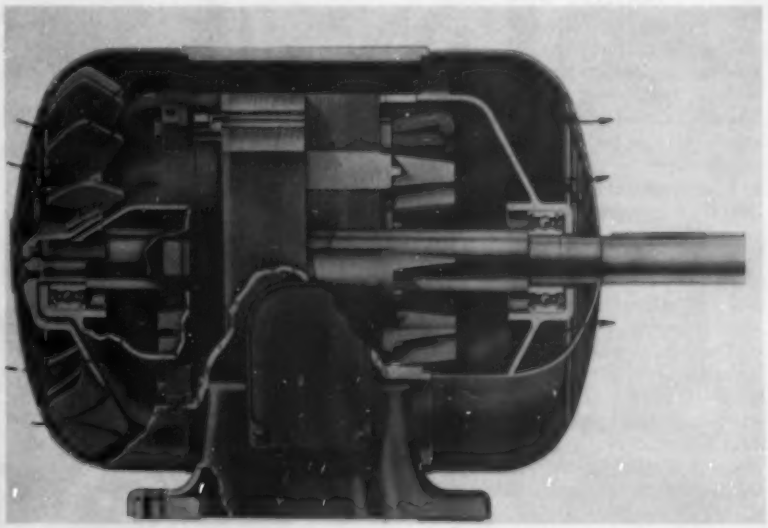
Many factors enter into the evaluation of the most economical method of operation under such conditions. For one thing, not all variable speed drivers are equally efficient. Considerable saving in power can be made by varying the speed of a steam turbine or an internal combustion engine drive. Slip ring motors and hydraulic and magnetic transmissions have efficiencies that vary practically proportionally to the rate of their operating speed and full load speed. Variable speed operation with these latter devices does not produce anywhere near the saving in power input as would be indicated by the reduction in pump power. In evaluation, care should be taken to consider the actual saving in power consumption along with the increased cost of the variable speed drive over a constant speed drive installation.

Variable Speed Drives

The choice of drivers suitable to variable speed operation is quite wide. Besides steam turbines, gasoline or diesel engines, it is possible to use slip ring wound rotor motors or, in certain cases, d-c electric motors. Even when synchronous or squirrel cage induction motors must be used, it is possible to apply a variable speed transmission such as the hydraulic or magnetic transmission. For the smaller power units, the mechanical variable speed devices using variable pitch sheaves and V-belts are applicable.

Dual Drives

A dual driven pump is one which can be driven by either one of two installed drivers. Generally, the two drivers are of different types; one being for regular use and the second being a standby. An example of one economical use of dual drives is an installation where a noncondensing steam turbine is run during the winter months when the exhaust steam is needed for plant heating and an electric motor operates the pump during the rest of the year.



Cross-section of a totally-enclosed, fan-cooled motor shows how the casing of the motor is cooled by air stream blown along it by the built-in fan.

The author adjusts equipment for high pressure testing of pneumatic cylinders.

Simple Unit Solves High Pressure Testing Problems

CLAYTON H. PROPPER
Chief Engineer
Herman Machine & Tool Co.

HIGH PRESSURE PNEUMATIC testing has always presented problems to industry. This type of testing equipment nearly always involves high cost, consumes large areas of factory space, and in many cases is not as efficient and safe as desired or required.

The Herman Machine & Tool Co., faced with these problems, designed and built its own special testing equipment which combines simplicity and effectiveness with low cost of operation and minimum of maintenance.

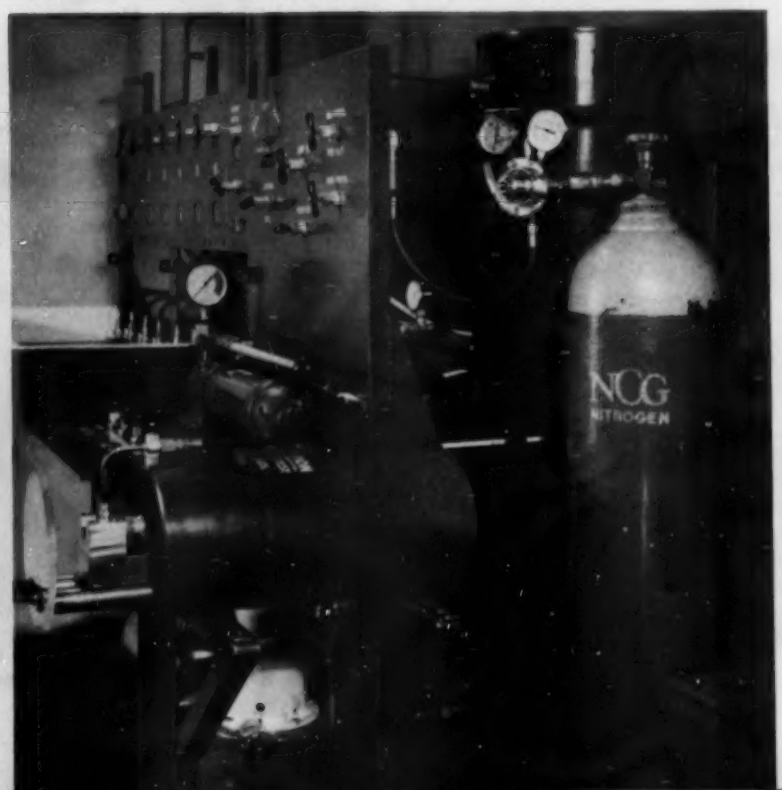
Testing equipment consists of a suitable steel stand having a Plexiglass covered inclosure in which the cylinders are placed for pressure and leakage tests (up to 10,000 psi). Each cylinder is individually connected with a supply of nitrogen gas through valves and gauges in a manner that permits the removal or replacement of any one cylinder at any time. It is of great advantage that each cylinder is connected separately and can be removed or installed at any time during the test without disturbing the test procedure of the remaining cylinders mounted on the same test stand.

The high pressure phase of the problem was solved by inter-connecting nitrogen gas with a closed hydraulic system. A control system, actuated by solenoid valves and mercury switches, returns the oil to storage and delivery tanks for use in the next compression cycle. This method eliminates refilling and waste and simplifies the operation and maintenance of the system. In this manner it is possible for all testing operations to be conducted by one person.

Operation

The cylinders are placed in the test stand, pre-set and locked into place at a comparatively low pressure. The operator makes sure that all cylinders are properly seated, then applies the high pressure.

The high pressure leakage test is performed by subjecting the cylinders, after they are mounted in the test stand, to a pressure of 3200 psi for five minutes. If leakage is present, the cylinder is removed from the stand and the cause of leakage determined and corrected.



Side view shows test stand, valves, gauges and nitrogen gas container.

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Thermocouple Data

THERMOCOUPLES are the heart of many industrial control systems. When a thermocouple has to be replaced, the new one should be of the same materials as that specified for the instrument already in use. The kind of thermocouple required is usually marked on the instrument scale.

The data in Table 1 presents a summary of the data to be considered when a new instrument is being chosen; in these cases, the choice of a thermocouple is not restricted by an instrument already on hand.

The wire sizes shown in Table 1 are nominal. Usually, heavier wire is required when the temperature to be measured is comparatively high. However, heavier wires reduce the sensitivity of the thermocouple; a compromise has to be made between sensitivity and the longer life of heavier wire.

In the temperature ranges for which Iron-Constantan or Chromel-Constantan are recommended, it is not necessary to use wires heavier than No. 8. All the lighter gages of Chromel-Alumel may be used up to 1600 F; from 1600 to 2000 F, No. 8 wire should be used; above 2000 F, No. 6 or heavier wire should be used.

The transfer of heat from the hot medium to the thermocouple measuring junction should be as rapid as possible. The rate of heat conductivity to the measuring junction is controlled by the kind of transfer medium (liquid or gas) in use and the characteristics of the thermocouple protecting tube.

Heat will be conducted along the thermocouple wires and the protecting tube to the point of lowest ambient temperature. This rate of heat conductivity varies with the thickness (mass) and material forming the protecting tube and on the size and composition of the thermocouple wire. Thermocouples made of thinner gage wire will usually give quicker response to temperature changes, but may have an appreciably shorter life span.

When thermocouples are used with automatic control instruments, it is necessary to have the thermocouple in such a position that it will always respond to a definite relationship within the process being controlled. This relationship should be constant.

If the thermocouple is in an atmosphere furnace, an immersion depth of 30 inches may be insufficient to obtain a true reading; on the other hand, an immersion depth of 5 inches may be adequate in a liquid salt bath. To test the depth, a bare thermocouple may be used to explore the inside of the protecting

TABLE 1 — SUMMARIZED DATA FOR SELECTION OF THERMOCOUPLES

Type	*Kind of Wire*	*Recommended Temperature Limits*	*Wire Size (See adjoining paragraphs)*	*Atmospheric Conditions for which Thermocouple is Best Suited**
Copper-Constantan	Copper-positive Constantan-negative	Minus 300 F to plus 600 F	No. 20	Generally of no great consequence in this temperature range
Chromel-Constantan	Chromel-positive Constantan-negative	0 to 1000 F	No. 14	Oxidizing or neutral
Iron-Constantan	Iron-positive Constantan-negative	0 to 1600 F	No. 8	Reducing or neutral
Chromel-Alumel	Chromel-positive Alumel-negative	600 to 2000 F (continuous); up to 2300 F (intermittent)	No. 8	Oxidizing or neutral
Platinum-Rhodium**	10% Rhodium, 90% Platinum } positive Pure Platinum-negative	1300 to 2700 F (continuous); up to 2850 F (intermittent)	No. 24	Requires protection from all atmospheres with ceramic tube
Platinum-Rhodium	13% Rhodium, 87% Platinum } positive Pure Platinum-negative	1300 to 2700 F (continuous); up to 2850 F (intermittent)	No. 24	Requires protection from all atmospheres with ceramic tube

*Bare thermocouples used in atmospheres or media causing chemical reaction will deteriorate the thermocouple and destroy its standard EMF temperature characteristics. See Table 2.
**Use for replacement purposes only.

Wheelco Instrument Division, Barber-Colman Company

tube. If by pulling the thermocouple out one inch from the depth being tested, the temperature indication does not change, it can be assumed that the depth under test is sufficient to obtain a true temperature indication.

Protecting Tubes

Thermocouples must be protected to insure long life and to maintain their inherent accuracy. Table 2 shows recommended tubes for various environments.

A thermocouple should have as little protection as possible consistent with favorable life characteristics. The protecting tubes reduce sensitivity and response speed. Nonetheless, corrosion, contamination, and abrasion would shorten the life of bare thermocouples; it is a matter of compromising adequate protection with desired operating characteristics.

The temperatures recommended in Table 2 are the maximums for continuous duty; for intermittent duty, higher temperatures can be tolerated. Heavier tubes are generally used for excessively corrosive or abrasive environments. Incoloy can be substituted for the applications listed in the table for Inconel.

Troubleshooting

Failures in a system may be the fault of the measuring instrument or the thermocouple itself. Among the troubles that may exist in the thermocouple are a poor connection in the thermocouple itself or in the thermocouple extension wire; gases or vapors may have seeped in around the thermocouple and affected it; or a short may have developed along the thermocouple or its extension wire at some point away from the measuring junction.

A quick check on the thermocouple can be made by moving it around slightly and observing if the instrument reading remains stable. If the reading is erratic, the thermocouple should be checked further.

To check the voltage output of the thermocouple, a potentiometer is required. The potentiometer can also be used to check the accuracy of the instrument reading.

TABLE 2 — SUMMARIZED DATA FOR SELECTION OF PROTECTING TUBES

Type of Environment	*Maximum Temp—F*	*Material of Tube*
Natural or oxidizing (ordinary heat treating)	2200	27% chromium iron
	2400	Pure nickel or porcelain
	2900	Porcelain
Neutral or reducing, carbon monoxide (such as gas curtain hardening)	2200	27% chromium iron
	2400	Pure nickel or porcelain
	2700	Porcelain
Hydrogen, ammonia (such as bright hardening or brazing)	1000	Wrought iron or seamless steel
	2200	Inconel or pure nickel or porcelain
	2700	Porcelain
Nitriding	2200	Inconel or nichrome
Slagging or corrosive action, neutral or oxidizing, (such as forging furnace or kilns)	2700	Silicon carbide
Slagging or corrosive action, neutral or reducing, (such as open hearth roof)	2500	Silicon carbide with inner porcelain
Sulfur content	2000	27% chromium iron
Sulfur dioxide	2200	Inconel
Hydrogen sulfide	1000	Inconel
Lead vapors (rare metal refining)	2200	Inconel
Steam	2000	Inconel
Carburizing	2000	27% chromium iron or Inconel
Cyanide or salt bath	1750	Drawn chromium iron (specially treated)
Salt bath	2400	Same material as pot or Inconel
Carburizing salts	2000	Same material as pot or Inconel
Dowtherm	—	Pure nickel or porcelain
Oil baths	—	Seamless steel or wrought iron
Glass	2800	Porcelain
Tin	—	Extra heavy wrought iron or seamless steel
Lead	1000	Extra heavy wrought iron or seamless steel
Lead	2000	27% chromium iron
Zinc (galvanizing)	1000	Extra heavy wrought iron (Put an open end pipe sleeve around the protecting tube; this should be changed when eaten through)
Brass	2100	27% chromium iron
Brass or copper alloys (intermittent only)	2300	27% chromium iron
Aluminum	1500	Cast iron; paint with whiting daily
Magnesium (Dow metal)	—	Extra heavy seamless steel or 27% chromium iron
Die cast metals	1200	Cast iron or extra heavy wrought iron; paint with whiting daily
Gas generating units	—	Inconel
Powder metallurgy	—	Inconel

Wheelco Instruments Division, Barber-Colman Company

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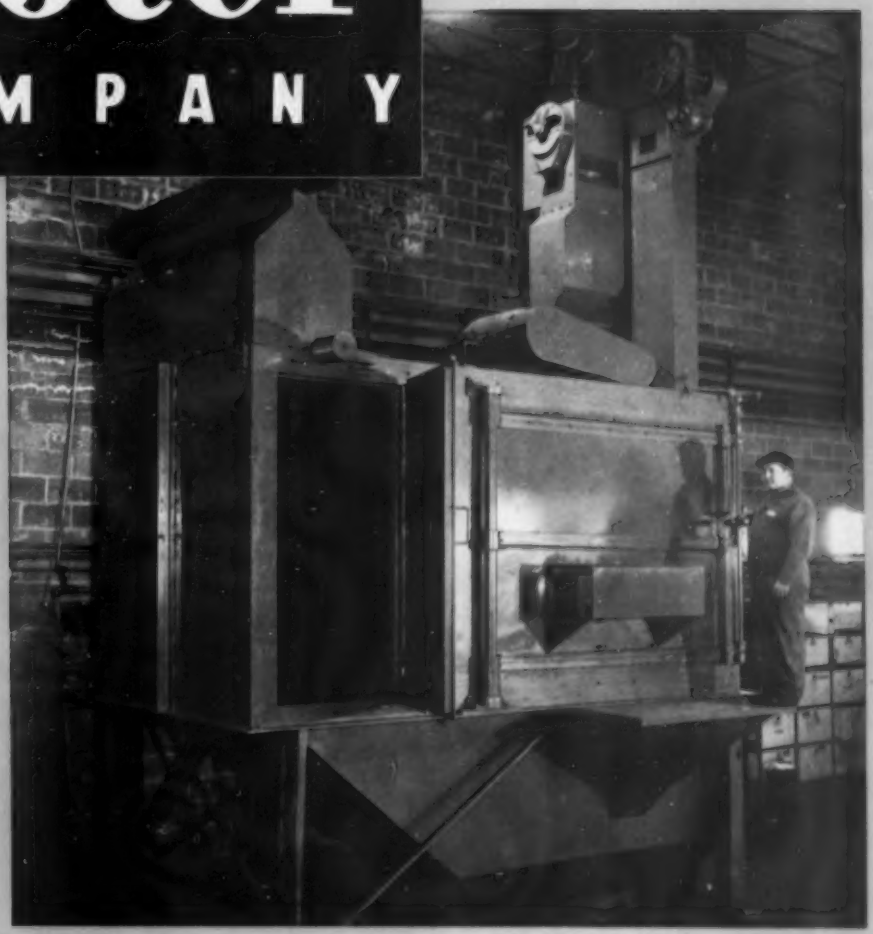

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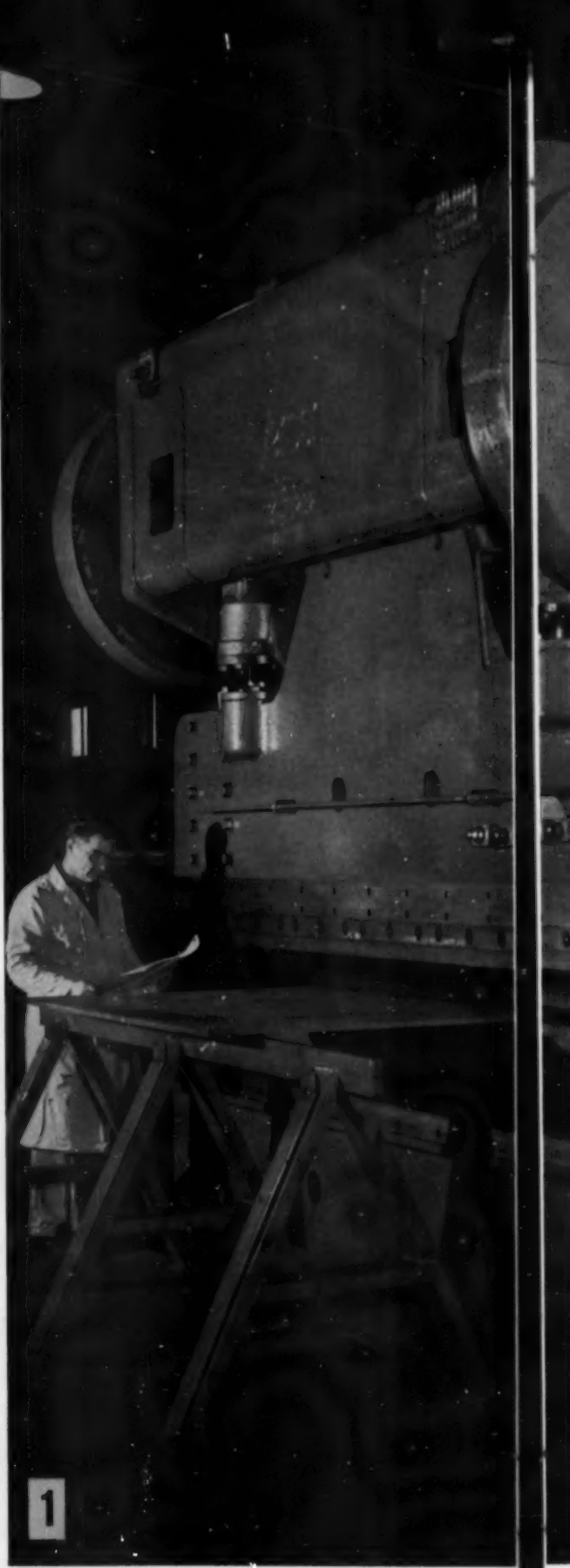
2 **FLAME-CUTTING MACHINES,** for cutting complex patterns, such as gears, cams and other intricate shapes—of unlimited thickness. Tolerances as low as five-thousandths can be maintained, reducing costly machining operations to a minimum.

3 **SQUARING SHEAR,** ¾" x 10' capacity, for accurate blanks. Also equipped with adjustable ram for notching and slitting special shapes of unlimited lengths.

4 **RADIAL DRILLS,** for heavy duty, high speed drilling, reaming, tapping, counter boring and similar operations.

Since steel can be cut or formed into almost any size, shape or thickness, many castings can be replaced by fabricated steel weldments. Recently we designed a fabricated machine base to replace a casting. The fabricated base weighs only half as much as the casting — yet has over twice the strength and rigidity. The savings of metal, easier machining qualities, freight and handling, are reducing the cost of this base by more than 50%.

Probably some of your cast parts can be replaced by fabricated steel, at comparable savings. And be sure to get our prices for frames, bases, large machinery parts — tanks, towers, components, or complete assemblies.



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Digesters
Stand Pipes
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Towers
Blower Housings
Heat Exchangers
Preheaters
Condensers
Process Equipment
Special Purpose Machinery

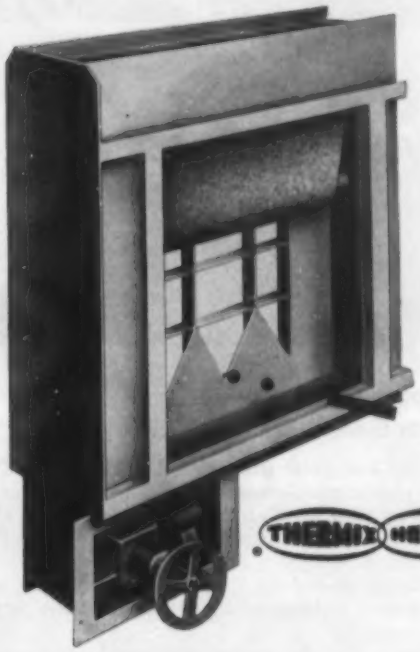
Transportation via railroads, motor freight and Illinois and St. Lawrence Waterways.

Conversion of this punch press frame—from castings to steel weldments—increased operating speed of the press fifty percent. Reduced manufacturing costs permitted substantial reduction of selling price. Future design improvements can be made at surprisingly small cost.

These blast furnace pre-heaters are another example of complex equipment fabricated by Foster.

THE foster COMPANY
ST. JOSEPH, MICHIGAN
Custom Metal Fabricators To American Industry

Only a Heacon Damper offers you this



"V" The V that gives you accurate control in the lower flow increments

Heacon Dampers provide the only solution to accurate flow control. With a background of over a decade of application to specialized problems, Heacon Dampers are accepted by engineers as the only means of accurate flow control, particularly in the lower flow increments.

V-porting is the secret. Heacon Dampers may be designed with V-porting to produce practically any flow characteristic from zero to 100%. With conventional dampers barely cracked, a flow of 10 to 20% or more is immediately released with resultant flow control problems in the entire system.

Heacon Dampers are a radical departure from normal damper construction. Consisting of supporting grill, sealing strip and flexible curtain of woven blue asbestos, metal or other suitable material as determined by the application, Heacon Dampers are recommended for use where these two factors, among others, are of major importance:

1.—Accurate control and ease of operation by either manual or mechanical means.

2.—Positive, tight seal when damper is closed.

The Thermix Corp., Project Engineers for Heacon Dampers are specialists in the application of this damper to your particular requirements. Why not call their engineers today.

Project Engineers

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spot news

. . . what's happening in U. S. industrial plants

Plastic Pipe Carries Water to Generating Plant

Corrosive well water will be conducted through Tenite Butyrate plastic pipe, in one of the first industrial installations of its kind, by Carolina Power and Light Co. at their new Wilmington Steam Electric Generating Plant, Wilmington, N. C.

The quarter-mile-long pipe line will deliver water from its source to large tanks where the water is to be decarbonized.

As shown in the picture, the 20-ft lengths of three inch diameter pipe were joined together by slip-sleeve couplings and solvent cement which provide, in effect, welded joints. It was not necessary to thread any of the couplings or pipe. The line was installed in less than half the time it would have taken to install metal pipe. Red brass pipe, the material originally considered, would have cost almost twice as much as the plastic pipe.

The line will be operated at about 50 psi and is buried 30 in. below the surface of the ground.

The installation was made under the supervision of Ebasco Services, Inc. Grinnell Corp. supplied the pipe which was extruded by Busada Manufacturing Co. Tenite butyrate plastic is marketed by Eastman Chemical Products, Inc.

How to Cut Grinding Costs Explained

Of the $160 million spent on grinding wheels last year, it is estimated that $60 million went for purchase of resin bonded wheels. The balance was mainly vitrified bonded wheels, with some rubber, silicate, and oxychloride included.

K. S. Cowlin, sales manager of the grinding wheel division of Electro Refractories & Abrasives suggests 14 possible means of economizing in grinding operations:

1. Select hardness compatible with grinding costs.
2. Use thinner wheels in certain applications. They may do the same amount of work.
3. Maintain surface speed through speed changes or additional machines to use partially worn wheels.
4. Take advantage of large hole allowances in resin wheels. It might pay to install adapter flanges.
5. Use a template for measuring worn wheels before removal.
6. Substitute an aluminum oxide wheel for silicon carbide in a non-ferrous foundry or where grey iron or hard malleable is to be ground.
7. Where portable cups are used, a wider rim for the same price or a straight sided cup might be practical.
8. Sometimes a dual specification wheel can be used effectively, but advantage must be weighed against cost.
9. Use a magnetic chuck to hold steel castings while swing grinding. Reduced vibration may cut wheel cost.
10. Hard-sided wheels at a slightly higher cost might be justified for grinding brake shoes and other castings where work is mostly corner grinding.
11. Employ wheels which have been treated with materials such as wax, particularly on brass and aluminum. The added charge for treated wheels proves worthwhile.
12. Unless castings have some dressing action, occasional dressing of wheels can be economical and a safety measure.
13. Wheel truing also adds to safety and restores normal contours of worn wheels.
14. Where large vitrified wheels are used, investigate the advisability of converting to resin wheels for increased operating surface ft per min and a tougher wheel.

Power Problem Met With Use of Gas Unit

At the dissolution of the North Continent Utilities Co. in 1945, the town of Farmington, New Mexico had acquired the distribution system for an area within a radius of 11 miles from the center of town and generating facilities consisting of a 200 kw hydro plant and a gas engine plant with two 300 hp Rathbun-Jones and one 250 hp Bruce-McBeth units. These modest facilities also supplied all of the San Juan County through the lines of the Basin Light & Power Co. Farmington then contracted with Basin to operate the city's power system.

Additional prime movers were added quickly in 1946 and 47: two more 250 hp Bruce-MacBeths and two 370 hp Ingersoll-Rands. By 1949, the oil and natural gas

Designed for today's *Tough* service demands

DROP FORGED VALVES AND FITTINGS FOR TOUGHNESS AND TROUBLE-FREE SERVICE

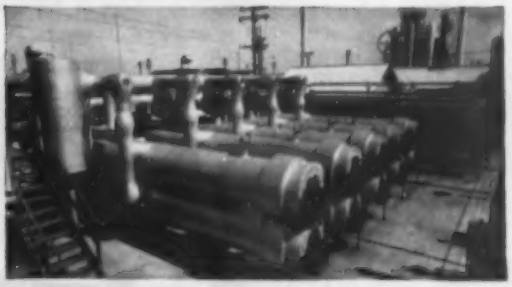
Drop forged from carbon and alloy steels, Vogt valves, fittings and flanges will safely handle liquids and gases at high pressures and high temperatures in power plants, chemical plants, petroleum refineries, etc. The complete line includes flanged, screwed and socket weld end globe, gate and check valves—ells, tees, and crosses—couplings—bushings—plugs—unions—flanges and flange unions—and welding heads.

MODERN STEAM GENERATORS

Vogt steam generators are designed to give maximum rating in a minimum of space, with high efficiency and low maintenance expense. Bent tube types and straight tube, forged steel sectional header types to burn solid, liquid or gaseous fuels meet every power, process or heating requirement.

PROCESS EQUIPMENT FOR EVERY SERVICE

Vogt constructs process equipment in wide variety to all Codes. Stills and towers, oil chillers, crystallizers, heat exchangers, molding machines, etc., serve in the manufacture of oils, greases, 100 octane gasoline, synthetic rubber, chemicals and related products around the world.



SPECIAL MATERIALS COMBAT CORROSION AND PRODUCT CONTAMINATION

Our modern shops produce a wide variety of equipment from special metals and alloys to fight corrosion and product discoloration or contamination. Fabrication procedures insure that corrosion resistant properties of welds will match that of the materials used to construct the equipment.

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More than 70 years of engineering and manufacturing experience is incorporated in Vogt refrigerating and ice making equipment. Absorption Systems, Compression Systems, and Tube-Ice Machines in a wide range of capacities serve industrial and processing plants, and institutions, here and abroad.

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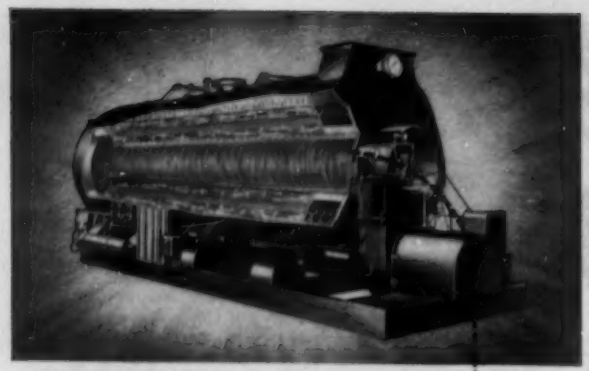

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• The Cyclotherm Cyclonic Combustion Principle is an entirely new and amazingly different method of heat transfer in the boiler industry.

• Air enters the combustion chamber at extremely high velocity in a revolving spiral vortex which travels the entire length of the furnace. The fuel is introduced into the entering air where it is slowly consumed as it moves in a cyclonic motion down the combustion chamber. This highly luminous slow burning flame radiating heat to the fire tube through direct radiation and by convection, results in an unusually high rate of heat transfer.

• *No matter what size the building or job, Cyclotherm has the correct installation. Send for your copy of "All Your Questions Are Answered by Cyclotherm" today and find out for yourself the facts concerning Cyclotherm Steam Generators.*

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spot news

—Starts on page 86

boom was under way and the city quickly constructed a new power house and installed two 250 hp Bruce-MacBeths and a 932 hp Ingersoll-Rand.

The next engine chosen was an 8-cylinder, 16 x 20 in., 360 rpm Worthington natural gas unit rated at 1525 hp at the plant's 5280-ft elevation. After an initial period of break-in and adjustment, the engine ran continuously for six months except for a total of 15 hours for inspection and preventive maintenance. In that six-month period, this one prime mover produced 3,659,700 kw hrs, more than 53 percent of the total 6,793,781 kw hrs generated by the whole system with its eleven engines and hydro plant.

To carry the peaks, all eleven engines must be run at full load, but in off-peak hours, the gas engine handles a large share of the work. The old plant averages about 20 cu ft of natural gas for each kw hr generated. At the new plant, with the big engine carrying ¾ of the output, average plant fuel consumption has gone as low as 12.05 cu ft per kw hr.

One of the first engines of its kind, this supercharged, high-compression, spark-ignition natural gas engine has a compression ratio of 12 to 1, equal to that of a diesel and is said to attain the efficiency of the diesel.

Generating Station Makes Use of Higher Steam Pressures

Objectives in the design of the new Kearny Generating Station in New Jersey were to achieve a plant which would be simply arranged with central control to reduce operating effort; a steam cycle to take advantage of high steam temperature and pressure; and a relatively small building resulting in low first-cost and maintenance.

The new station has for its principal equipment, two General Electric Co. turbine generators, and two water-tube, controlled circulation Combustion Engineering boilers arranged in the unit system.

The entire plant is operated from a control room located at operating floor level in the center of the square formed by the four major items of equipment. The new units are operated as a separate station with practically no ties, electrically or mechanically, with the old station

The Cover — Ventilation

Photo by Westinghouse

Because of the possibility of radioactive air being present, special ventilating equipment had to be installed by Westinghouse at the AEC Idaho test facility where the world's first atomic submarine engine was built. Should there be a build up in the concentration of radioactivity in the air, six large fans, one under each of the stacks pictured, would be automatically turned on.

NO Reducing Valve Needed

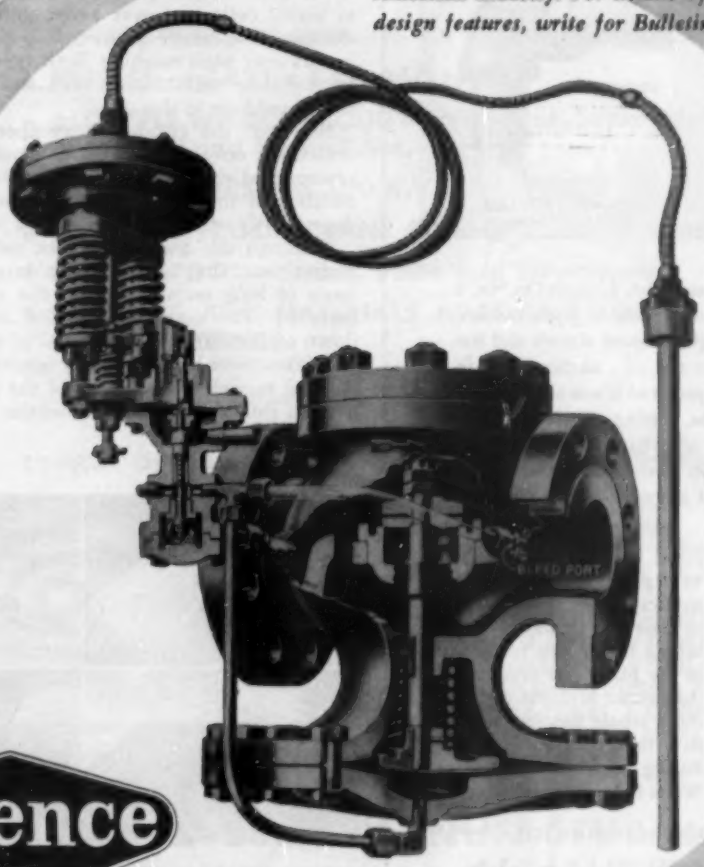
Here's real economy in temperature control.

Because Spence Temperature Regulators are designed to limit heater steam pressures to an adjustable maximum, the need for a separate reducing valve is completely eliminated.

The Spence Regulator takes steam directly from the boiler or high pressure line, reduces the pressure and regulates the flow as required to maintain a constant temperature output from the heater.

This means one relatively small combination pressure and temperature regulator replaces a reducing valve of the same size and a larger temperature regulator. Practically the entire cost of the large separate temperature regulator is saved. And, the total saving would also include the cost of a 3-valve by-pass along with all labor for installation.

This design feature is just one of the reasons for the thousands of Spence installations throughout American industry. *For details of other important design features, write for Bulletin T50.*



SPENCE
TYPE ET150
Temperature
Regulator

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

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Stopping Pipe Leak

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SMOOTH-ON

THE IRON CEMENT OF MANY USES

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spot news

—Starts on page 86

next door. The boilers are close to the turbines, hence the steam leads are short. The coal pulverizers are placed alongside and between the boilers and are enclosed in a separate ventilated room. The feeders of all pulverizers are accessible from one platform.

The new Kearny Generating Station is designed for two-level operation, with the two levels 15 ft apart. All parts of the boilers are out-of-doors except the burner areas and the bottoms of the furnaces.

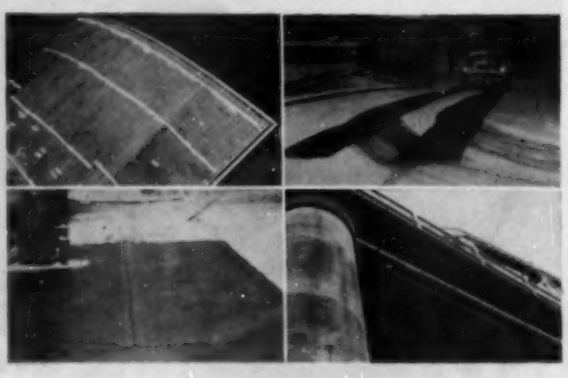
With completion of this station with its two 145,000 kw steam turbine-generator units, the Public Service Electric and Gas Co. system is increased to 1,910,300 kw.

Tap Maker Chooses Unit Dust Collectors

Two types of dust control systems were reviewed when a Cincinnati producer of precision taps decided to install collectors over seven universal grinders. The decision was between a central system and unit collectors over each machine. Both types could be installed by the shop maintenance men and both would return the cleaned air to the shop.

However, the grinders were operated intermittently, sometimes only one or two at a time. With the central system that would mean running the 7½ hp motor regardless of the load. The single collectors operate independently of one another on 1/3 hp motors.

Although the cost of the unit collectors was slightly higher than that of the single large collector, on the basis of long term economy, the separate units were installed. The responsibility for maintenance—shakedown of the filters and removal of the dust each day—was taken over by the grinder operator. This system has worked so well that the life of the filters has been ten months rather than the six months anticipated.



Electric Heating Cable Has Many Applications

Applications of Chromalox electric heating cable show how pipe lines, sidewalks, roofs, and other exposed locations can be protected in winter from ice, snow, and

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Complete Fabricating and Assembling Facilities for any type, size and quantity of sheet and plate products and weldments thru ⅜" thickness.

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- **PRESSES—to 48" x 84", 250 tons.**
- **ALL TYPES WELDING EQUIPMENT—Spot, Seam, Heliarc, Automatic and Manual Arc.**
- **SEAM WELDERS—to 200 K.V.A.**
- **ASSEMBLY FLOOR CRANE CAPACITY—to 25 tons.**
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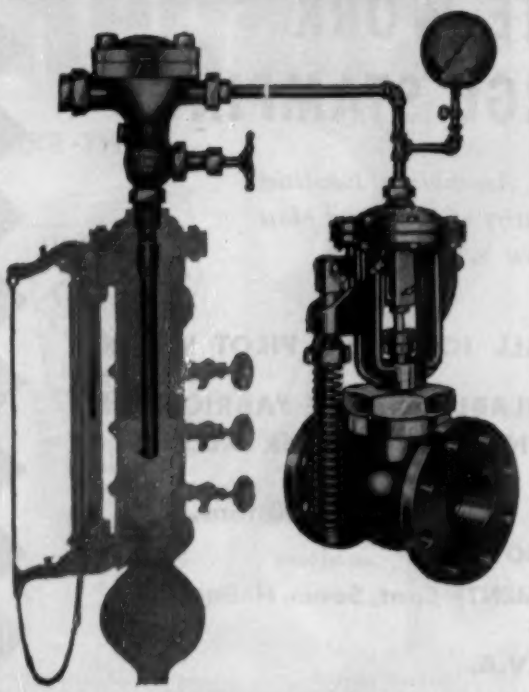
CAMPBELL
Boiler Feed Water Regulator



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why boiler operators, the world over, continue to specify the CAMPBELL

1–Continuous Blowdown;
2–No Moving Parts;
3–No Thermostats;
4–No Floats;
5–No Links;
6–No Generators.

The CAMPBELL maintains a constant water level when the load is steady.

Compensates quickly for momentary changes in water level caused by sudden increase or decrease in steam demand.

Nothing to get out of order or require adjustment. As easily installed as cutting a valve in a pipe line.

For complete information ask for Bulletin 8-A.

Other ATLAS Regulating Devices: Reducing Valves; Damper Regulators; Temperature Regulators; Exhaust Control Systems; Back Pressure Valves; Float Valves; Pressure Regulators; Pump Governors; Balanced Valves; Control Valves; Oil Control Cocks; Etc. ATLAS has been in the regulating valve business exclusively for more than a half century.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

287 South Street Newark 5, New Jersey
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spot news

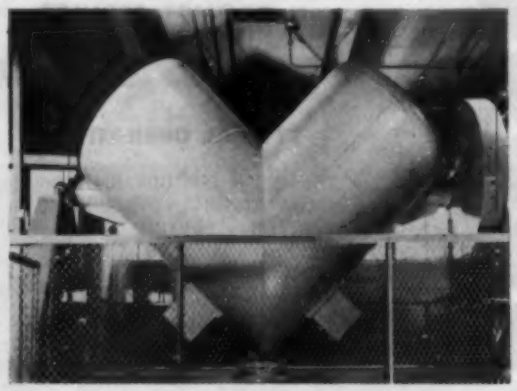
—Starts on page 86

sub-freezing temperatures. Economical use of plastic-covered Thermwire is shown by installations that were made during normal maintenance periods or at the time of new construction—and that now operate only when required by weather conditions.

Over the attractive entrance to the new Alcoa Building in Pittsburgh, the Aluminum Company of America installed 1600 ft of the cable on top of the canopy's cantilevered reinforced concrete shell to prevent snow and ice accumulations. Now, with a capacity of only eight kw operating at infrequent intervals, both initial and operating costs have been found to be nominal.

The manufacturer of the heating cable, Edwin L. Wiegand Co., embedded the cable in two tracks on the slope of a driveway to their parking lot to assure smooth flow of traffic during snows. Then, during repaving of the area around a warehouse, Thermwire was embedded in the concrete sidewalk and steps to eliminate the need for shoveling snow and to provide greater safety for employees. The cable has also been installed around several stacks on the roof of the plant to prevent condensation from forming inside.

At Applewold, Pa., Thermwire is wrapped around a 150-ft section of the supply pipe attached to the under side of a bridge crossing the Allegheny River—a location that would have been inaccessible for any other heating method. Before the cable was applied, water had been freezing in the last 55 ft of travel. Now, a continuous supply of water is assured by energizing the 18-kw installation when required by weather conditions and reduced rate of flow in the pipe.

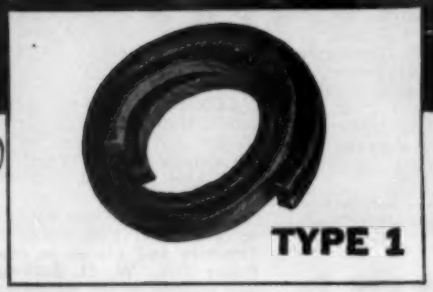


Twin-Shell Blender Mixes Faster

Newest twin-shell blender to be installed at the Hoffman-La Roche, Inc. pharmaceutical plant has a 150-cu ft working capacity and will mix more than 8000 lb of ascorbic acid in one operation. Purchase of the large Patterson-Kelley blender follows about a year's experience with two smaller ones. The first of these, with a

(Continued on page 115)

R/M's BIG 7 Packing Types meet 95% of all packing needs



Circulating pumps like this one, which is used to circulate water to a cooling tower, give top performance with R/M Packing No. 1840, a universal packing included in Type 1 of R/M's Big 7 Packing Types.

Let R/M lower your maintenance costs

R/M's Big 7 Packing Types are engineered to give custom-built performance in all but the very rarest packing applications. By standardizing on this basic line of just seven field-tested packing types (you probably need only three or four in your plant) you can reduce the number of times you have to re-pack, the labor costs of packing, the labor costs of "too frequent" adjustments, the costs of damage to equipment, and the costs caused by non-uniform performance. You will also be able to cut your packing inventory and simplify your ordering. For details, call in your R/M distributor.

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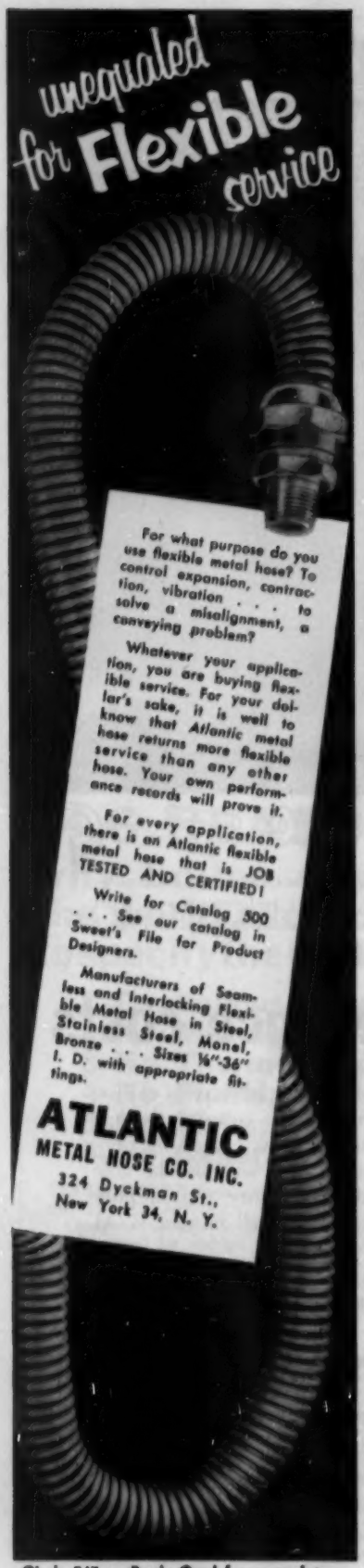
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names make news

. . . personalities from industry and power

National Association of Silo Manufacturers — C. B. Ross, vice president in charge of production of the **Marietta Concrete Corp.** at its Baltimore, Md., plant, recently concluded his second term as president of the association. **Ben Gurney** of the **Madison Silo Company** is elected president of NASM for 1954.

U. S. Electrical Motors, Inc. marked the beginning of an $8 million industrial development for Orange County, California, when ground was broken December 18 on the 89-acre site of the company on the Santa Ana Freeway.

Universal Atlas Cement Co. — The appointment of **James T. Maher** as assistant to vice president, sales, eastern and southern region is announced.

General Electric Co. announces the construction of a new laboratory at Schenectady to help house its expanding activities in the fields of radioactivity and radiation.

Pier A. Abetti, 32-year-old G. E. employee, is selected as the nation's outstanding young electrical engineer for 1953 by Eta Kappa Nu Assoc., a national electrical engineering honor society.

GE's Power Transformer Dept. announces appointment of **Edward E. Bauer** as superintendent of regulator manufacturing.

Frank M. Mansfield, III has joined the Carboloy Dept. as manager of product programming.

Allis-Chalmers Manufacturing Co. announces the completion of plans to enlarge the manufacturing facilities at its Terre Haute, Indiana Works. Construction will start immediately under an extension of the present contract with **The Austin Company** and the addition will be of the same type of construction as the original buildings completed last year.

Named assistant production control manager at West Allis Works is **Robert L. Carlstein. William H. Schrinner** succeeds Carlstein as superintendent of material control.

Elliott Co.—Raymond V. Thayer is appointed Cincinnati district manager.

Boston Woven Hose & Rubber Co., Plastics Div. has named **George A. Ryan** sales engineer.

The Trane Co. is appointing new engineering representatives to sales offices: in St. Paul, Minn., **Phillip D. Freeman;** DesMoines, Iowa, **Richard E. Jameson;** Billings, Mont., **Dennis W. Nelson.**

The new branch sales office in Pensacola, Fla. is to be headed by **Marvin R. Clemons.**

H. K. Porter Co., Inc., Quaker Rubber Corp. Div. announces appointment of **M. G. Lucke** as superintendent of moulded hose.

Boston Woven Hose & Rubber Co. — Product development manager of tubing and extrusions will be **Eugene W. Caton.**

Flexonics Corp.—Kenneth H. Flory moves up from assistant purchasing agent to purchasing agent.

American Locomotive Co. — Regional sales manager for the Alco Products Div. will be **A. T. Lawrence. Charles H. Homer, Jr.** is named manager of the Beaumont Iron Works plant.

In the new marketing organization for all Alco products, **William A. Callison** is named vp in charge of customer relations; **William F. Lewis** is appointed vp in charge of marketing; and **Arthur T. Lawrance** is named general manager of field sales.

International Nickel Co., Inc. announces that **Robert J. Johnson,** metallurgist has joined the staff of the Pittsburgh Technical Section of the Research Div.

Link-Belt Co. has established a scholarship to help a worthy student obtain an education in mechanical, metallurgical, or industrial engineering at Illinois Institute of Technology.

Babcock & Wilcox Co.—M. Nielsen, vp of B & W, is elected to the board of directors and placed in charge of the Boiler Div. **W. D. Sullivan** succeeds him as head of the manufacturing dept of the Boiler Div. He also becomes a vp of B & W.

Grinnell Company, Inc. announces appointment of **Helmut Thielsch** as metallurgical engineer of the Industrial Piping Div. He will also represent the company on several major technical committees concerned with the fabrication of piping.

Robertshaw-Fulton Controls Co. announces the appointment of **Thomas H. Jeffers** to the new position of assistant general manager of the Anaheim Div. and his election as an assistant vp of the company.

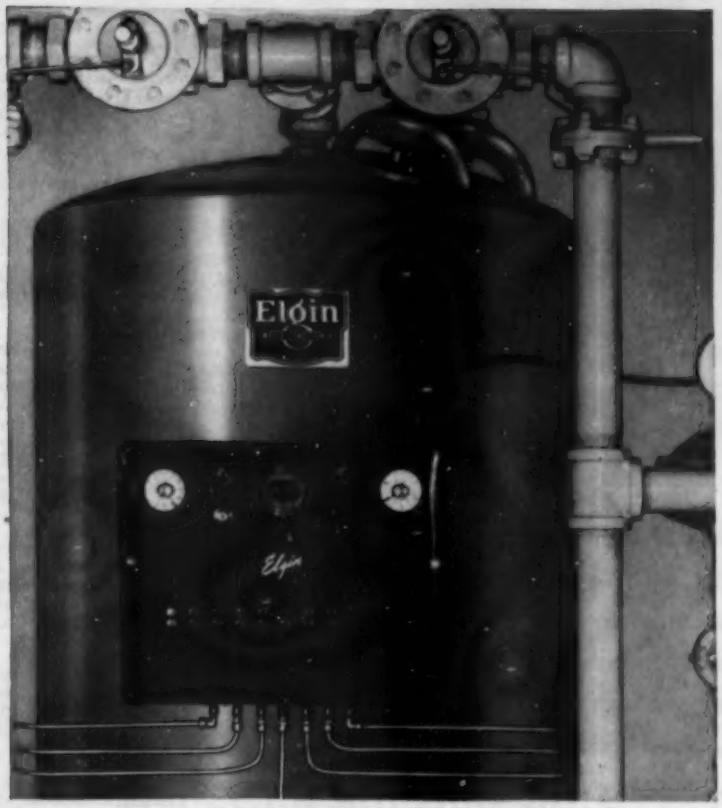
Robert O'Hara has been added to the staff of the Detroit office of the Fielden Instrument Div.

L. J. Wing Mfg. Co. is awarded a contract from the U. S. Navy in the amount of $1½ million for airfoil fans of the vaneaxial and tubeaxial type for ship ventilation.

Southern Coal Co., Inc. announced appointment of **Fred L. Buckner** as district manager, Louisville, Ky.

Panalarm Products, Inc. has appointed **Howard W. Hudson** as vice

ELGIN ULTRAMATIC



America's Finest AUTOMATIC WATER SOFTENER

It's Hydraulically Operated by Magic Pilot

Costly Loss of Zeolite Prevented

The zeolite ion exchange material in this water softener is *"locked in"* by an ingenious "Double Check" manifold system to prevent costly loss, and to give more efficient regeneration. This manifold also permits far more exchange material to be placed in the softener to give up to 44% greater capacity so that a smaller unit will meet the need.

Your Softener Easily Converted to Automatic Operation

Save valuable manhours, eliminate human error, and increase the efficiency of your present water softener by converting to automatic operation. Write for details.

Here is today's most dependable automatic water softener—a product that sums up the best of all we have learned in nearly a half century of experience. It operates on the time proved hydraulic valve principle and is controlled by a new and unique automatic pilot to deliver a constant supply of zero soft water without attention.

The time interval and flow rate of each regenerating step of the Ultramatic is individually adjustable for maximum efficiency under any operating requirement or water characteristic. The reasons why this flexibility is highly essential to satisfactory performance, together with complete information about this water softener, are given in Bulletin 612. Write for your copy.

Elgin REFINITE SINCE 1905

ELGIN-REFINITE

DIVISION OF ELGIN SOFTENER CORPORATION

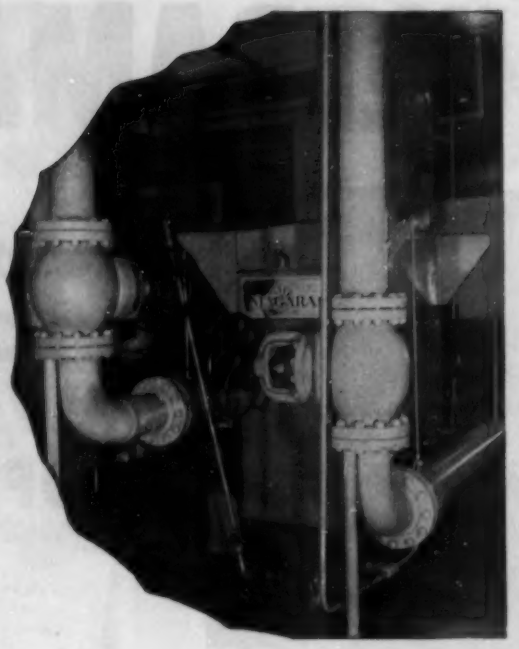
138 NORTH GROVE AVENUE, ELGIN, ILLINOIS

In Canada: G. F. Sterne & Sons, Brantford

OTHER PRODUCTS WRITE FOR BULLETINS { Delonizers • Dealkalizers • Lime Soda Softeners • Deaerating Heaters • Filters • Treatment

Circle 548 on Reply Card for more data

How to get drier or cooler air or gases . . .



NIAGARA AERO AFTER COOLER cools a compressed gas, or air, below the temperature of the surrounding atmosphere, thus preventing the condensation of moisture in your lines. The gas will contain only half of the moisture left in it by conventional methods. Even drier gas can be produced if you require it.

In working with controlled atmospheres of inert gases to prevent undesired reactions, this dryness of the gas at low cost is a great advantage. The cost of the Niagara method is low because it uses evaporative cooling, saving 95% of the cost of cooling water (and its piping and pumping). This direct saving of cost pays for the Niagara cooler in less than two years.

If you use compressed air to operate tools or pneumatic equipment you save much in water and oil damage to tools and equipment, and in water damage to materials by using the Niagara Aero After Cooler.

Write for a bulletin, or ask nearest Niagara Field Engineer if you have a problem involving the industrial use of air.

NIAGARA BLOWER COMPANY

Over 35 Years' Service in Industrial Air Engineering

Dept. IP, 405 Lexington Ave. **New York 17, N. Y.**

Experienced Field Engineers in Principal Cities of U. S. and Canada

Circle 549 on Reply Card for more data

names

—Starts on page 94

president in charge of the company's engineering and production activities.

Hewitt-Robins Inc. has transferred **H. C. Heine,** formerly assistant manager of the central sales div. in Chicago, to the company's executive offices in Connecticut where he will supervise distribution of products.

Le Roi Co., a subsidiary of Westinghouse Air Brake Co., names **Herschel V. Hiatt** as director of engineering for the Milwaukee Div.

The Bristol Co. names **John G. Fleming** to the newly created position of product planning manager.

National Association of Corrosion Engineers—**Kempton H. Roll,** Lead Industries Assoc., is elected chairman of the Northeast Region; **Edward G. Brink,** American Viscose Corp., vice-chairman; **Edwin J. Titsworth,** Koppers Co., Inc., sec'y-treas. **George E. Best,** Mutual Chemical Co., is elected to a three-year term on the NACE board.

Claude B. Schneible Co. announces the appointment of **Tom Butler** as a special representative for engineering problems involving installation of the company's dust collecting systems for foundry operations.

Weston Electrical Instrument Corp.—**Frank X. Lamb,** chief engineer, takes on the additional responsibilities of vp. **Roswell W. Gilbert** becomes assistant to the president.

Orr & Sembower, Inc. announces appointment of **J. Frederick Keeler** as sales representative for central Pennsylvania.

A. M. Byers Co.—**A. B. Drastrup** is elected as executive vp; **J. F. Byers, Jr.,** and **B. M. Byers** become vice presidents.

Darling Valve & Mfg. Co. announces appointment of **Bertil E. Engstrom** as midwest regional sales manager.

Dravo Corp. — **H. E. Lore,** manager of engineering and construction for the Machinery Div., is elected president of the Dravo Engineers' Club. Other officers are: **D. A. Booth,** vp; **S. J. McClatchey,** sec'y; **H. L. Wright,** treas. Appointments within the company include; **D. R. Berg** as manager of piping dept.; **W. L. Davidson,** manager of heating dept.; **E. N. Hower,** assistant manager of apparatus dept. **T. L. Hartman, Sr.** is assigned to special development work in connection with certain new processes and products.

Preferred Utilities Mfg. Corp. announces appointment of Nevans Co. of Houston, Texas as exclusive sales representative for the Preferred unit steam generator in the east Texas area.

Golden-Anderson Valve Specialty Co. has moved its general offices to new and larger quarters at 1232 Ridge Ave., Pittsburgh.

It's still coal that puts flavor in the roast

Like millions of other farm women, Mrs. Curtis now enjoys the convenience of a gas or electric range, along with refrigeration, a food freezer, running water, a power washer and all the other modern, labor-saving appliances.

But it's still coal that puts the flavor in the roast – bituminous coal, used efficiently in a distant power plant. America's public utilities are burning more than twice as much coal today as they did twenty years ago. Except in a few areas where other fuels are abnormally low in price, coal is the cheapest source of energy – cheaper even than water power. The TVA is now supplementing its great hydroelectric installations with coal-burning steam plants.

Another reason large fuel buyers favor coal is the assurance of continued supply. Even at our ever-mounting rate of consumption, known reserves are ample for a future measured in thousands of years. These reserves are well distributed over the United States and great coal hauling railroads like the Chesapeake and Ohio are equipped to handle enormous quantities of coal promptly and efficiently.

Chesapeake and Ohio Railway

Bring your fuel problems to C & O

As the world's largest carrier of bituminous coal, the C&O is intimately familiar with every phase of coal use. We have a large staff of experts who will gladly help you to locate the coal best suited to your needs; to help you use it most efficiently; to help get it to you promptly.

Write to:
Coal Traffic Department
Chesapeake and Ohio Railway
2110 Terminal Tower
Cleveland 1, Ohio

COAL... FUEL OF THE FUTURE

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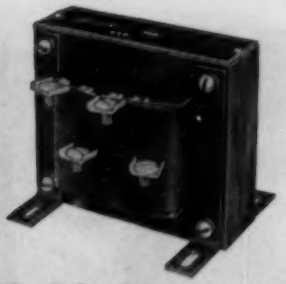
MACHINE TOOL
CONTROL
TRANSFORMER



IS ENGINEERED TO PROVIDE
THE REGULATION YOU NEED

This New Series Acme Electric Machine Tool Control Transformer more adequately withstands the low power factor and current surges when solenoids, contactors and switches of machine tool controls go into action. Sturdily constructed to provide adequate capacity for momentary overloads. Compare regulation curves. Write for Bulletin CT 194.

ACME ELECTRIC CORPORATION
MAIN PLANT: 523 WATER STREET • CUBA, N. Y.
West Coast Engineering Laboratories:
1375 W. Jefferson Blvd., Los Angeles, Cal.
In Canada: Acme Electric Corp. Ltd. • 50 North Line Rd. • Toronto, Ont.

Acme Electric
TRANSFORMERS

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meetings

. . . and exhibitions

Mar. 15-19	National Association of Corrosion Engineers (10th Annual Conference)	Muehlebach Hotel Kansas City, Mo.
April 1-3	Electrical Maintenance Engineers Association of Southern California (Industry Show)	Shrine Hall Los Angeles
April 15-19	American Institute of Electrical Engineers (Southern Textile Conference)	Georgia Tech. Atlanta, Ga.
April 26-30	American Society of Tool Engineers (Industrial Exposition)	Convention Center Philadelphia, Pa.
May 4-17	American Welding Society (Spring Meeting)	Statler Hotel Buffalo, N. Y.
May 10-12	Compressed Air and Gas Institute (Spring Meeting)	The Homestead Hot Springs, Va.
May 16-19	American Institute of Chemical Engineers (Summer Meeting)	Springfield, Mass.
May 17-20	Basic Materials Conference (2nd Annual Exposition)	Amphitheater Chicago, Ill.

Pick INSTANTANEOUS HOT WATER HEATERS
ENGINEERED FOR SERVICE

Industries everywhere are replacing outmoded water heaters with Pick Instantaneous Water Heaters. Here are the reasons:

★ Water Is Heated Instantly. Entirely automatic, Pick Heaters operate by steam injection to heat the water in a flash to exact temperature desired and in volume required.

★ Fuel Savings Are Substantial. Steam injection heating is the most efficient method known. There's no waste because water is heated only as used . . . never stored and allowed to cool.

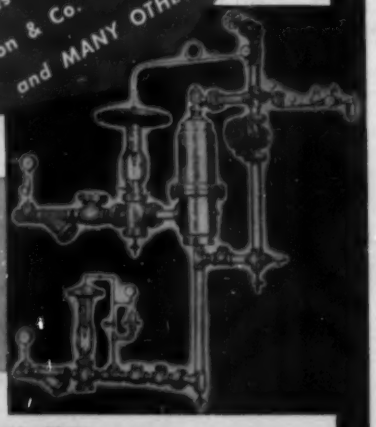
★ No Storage Tanks Required. Compact design of Pick Heaters permits out-of-the-way installation in corners, on walls or overhead. Saves valuable floor space.

★ Exact Temperature Control. Pick heaters can be operated at low or high loads with minimum temperature fluctuation. And it's done quietly.

★ Maintenance Cost Is Low. Pick Heaters can be cleaned in a matter of minutes — worn parts easily replaced.

★ Installation Is Inexpensive. Only ordinary pipe connections are required.

PICK HOT WATER HEATERS . . . Used by
• United States Steel Co.
• Ford Motor Co.
• H. J. Heinz
• Bethlehem Steel Corp.
• Hercules Powder
• Wilson & Co.
and MANY OTHERS



SAVES MONEY FOR ANY INDUSTRY THAT USES HOT WATER!

Write for booklet on how PICK HEATERS cut costs of Hot Water — No Obligation. Write CE 154

PICK MANUFACTURING CO. • WEST BEND, WIS.

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Have you a fly ash recovery problem?

Bring it to
WESTERN PRECIPITATION

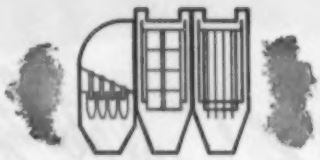
... The Only Organization With Years Of "Know-How" In BOTH *Electrical* And *Mechanical* Recovery Methods!

If you have any kind of a suspension-recovery problem—whether dust, fly ash, fume, fog or mists—it will pay you to bring it to the leading organization in the field ... WESTERN PRECIPITATION CORPORATION. Western Precipitation not only pioneered, over 44 years ago, the first commercial application of the now-famous COTTRELL Electrical Precipitators, but also has been a leader for many years in the *mechanical* recovery field with its widely-accepted MULTICLONE Collectors.

Result:

Western Precipitation is unsurpassed in the all-important factor of "know-how" in BOTH the electrical and mechanical fields ... knows from years of first-hand experience whether your particular problem can best be solved by mechanical or electrical methods—*or by a combination of the two* ... can give you a direct and unbiased recommendation on the matter ... and then can provide the complete installation under *one* responsibility, *one* overall performance guarantee, even where Combination Multiclone-Precipitator (CMP) installations are made!

Western Precipitation products and services include ...



COTTRELL
Electrical Precipitators

... the most efficient recovery equipment for high recovery, long life, low maintenance on practically any type of suspensions, wet or dry. COTTRELLS can be designed to handle a few c.f.m. —or millions—with equal ease, and at virtually any operating temperature. Recovery efficiencies closely approach 100% recovery, if desired, with very low draft loss, minimum power costs and negligible labor costs. *By all standards, Western Precipitation COTTRELLS give highest recovery at lowest cost per-year-of-service!*

MULTICLONE
Mechanical Collectors

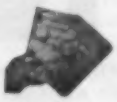
... the most efficient, most compact, most trouble-free mechanical equipment for recovering suspensions from gases. Because of their unique small-tube design, MULTICLONES are unsurpassed in mechanical recovery efficiencies—require less space, less maintenance, and are far simpler to install. No filters or screens to replace, nothing to burn or cause fire hazards, no high speed moving parts to repair or replace. These and many other advantages make MULTICLONE Collectors the logical choice on installations where mechanical recovery is selected.

CMP UNITS
(Combination Multiclone-Precipitator)

... combine, in *one* compact installation, both mechanical and electrical recovery principles so that maximum benefit is obtained from the advantages inherent in each method. The MULTICLONE section centrifugally removes the larger and heavier suspensions (down to a few microns in diameter) ... and the COTTRELL section then electrically removes the very small particles remaining in the gases. Thus, the bulk of the recovery is obtained with relatively low-cost equipment, and the final clean-up is obtained with equipment having unusually high recovery efficiency—approaching theoretically perfect, if desired.

The recovery of suspensions from gases is a highly exact science and every problem is different. Some require mechanical methods—others electrical methods—still others a combination of mechanical and electrical methods in proper balance to meet the individual requirements of each application. No matter what your problem, remember that only Western Precipitation has had years of field experience in BOTH mechanical and electrical methods!

Send for descriptive literature!



Let our experienced engineers study your recovery requirements and make an unbiased recommendation on the equipment best suited to your particular problem. A wire, phone call or letter to our nearest office places this unique "know-how" at your service, without obligation.

WESTERN Precipitation CORPORATION

DESIGNERS AND MANUFACTURERS OF EQUIPMENT FOR COLLECTION OF SUSPENDED MATERIALS FROM GASES & LIQUIDS

Main Offices: 1057 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA
CHRYSLER BLDG., NEW YORK 17 • 1 N. La SALLE ST. BLDG., CHICAGO 2
1429 PEACHTREE ST. N.E., ATLANTA 5 • HOBART BLDG., SAN FRANCISCO 4
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

MULTICLONE—T.M. Reg.

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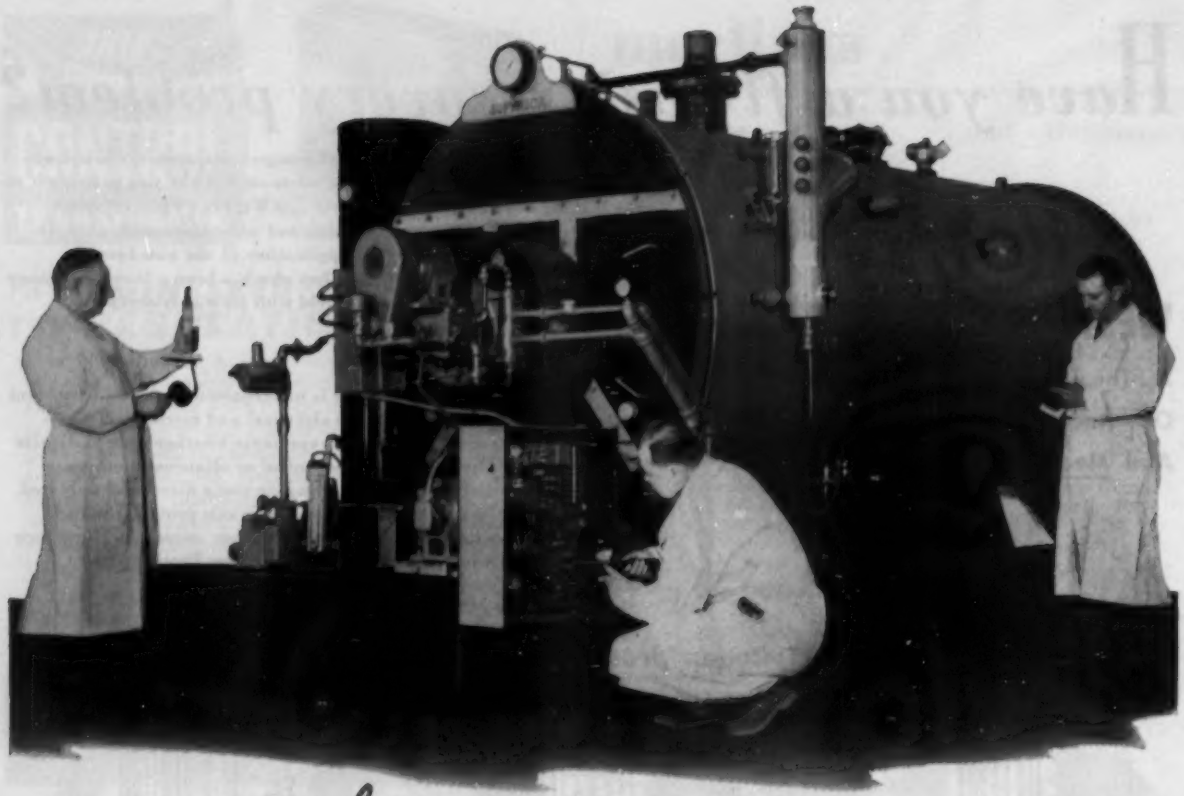

Completely FACTORY ASSEMBLED and TESTED ...for a GUARANTEED RESULT

Five Superior Steam Generators ranging in size from 30 to 600 b.h.p. on the test line at the Superior plant in Emmaus, Pa.

There's no guesswork about the performance of a Superior Steam Generator. Complete factory assembly followed by efficiency tests conducted *at the factory* under actual firing conditions guarantee operation at more than 80% thermal efficiency.

And because they are completely factory assembled and factory tested, they arrive at your plant ready to go to work . . . *backed by undivided responsibility*.

Fully automatic, firing either gas or oil, installation is simplified and inexpensive. Their rigid channel iron base eliminates the need of special foundations. Superior's built-in induced draft makes an expensive chimney unnecessary. All interconnecting piping and wiring is completed at the factory . . . ready for connection to supply services and steam outlet.

When the accent is on modernization, buy a Superior Steam Generator. It's the modern way to buy economical steam.

18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i. or for hot water. For complete details, write for Catalog 602.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR STEAM GENERATORS

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readers' guide

. . . an index to advertised products

The table below lists, according to product groupings, all equipment advertised in this issue. To request more data, circle key numbers on Reply Cards, pages 36/37 & 100/101

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bulletins

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AIR FILTERS & DUST COLLECTORS

226—Dust Collectors

Dust collectors, including cyclone, wet or dry dynamic, and cloth screen arrestor types are the subject of a 32-page bulletin. Uses of air conditioning, ventilating, conveying, drying, and cooling units are presented by means of illustrated industrial installations. Kirk & Blum Mfg. Co.

227—Tubular Dust Collectors

Problems of fly ash collection are discussed in eight-page brochure 4P201. Tubular Aerotec dust collectors are described, and efficiency curves, arrangements, and standard dimensions are presented. Flue gas density tables, and a formula and monograph for calculating the number of tubes required for any volume and resistance, are presented to aid in selecting dimensions for a unit to satisfy space requirements. The Thermix Corp.

228—Industrial Dusts

"The Collection and Recovery of Industrial Dusts," 32-page manual 101, discusses various types of dust and techniques used in analysis, lists the factors which influence choice of equipment, and explains the operation of each type of collector. Buell Engineering Co., Inc.

229—Dust Collectors and Arrestors

Series of four folders describes cyclone type collector and portable, standard, and automatic bag-type dust arrestors. Also includes 32-page catalog describing exhaust fans for dust collecting and air handling. Northern Blower Co.

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230—Precipitation Equipment

Engineers contemplating the installation of equipment for recovering dusts, fly ash, fumes, mists, fogs, or other similar suspensions in stack or process gases will find much valuable data in this 40 page booklet. It summarizes the latest advancements in this company's precipitator equipment, outlines various types of electrode designs, shell constructions, electronic and mechanical rectifier systems, and also gives helpful information on combination mechanical-electrical recovery systems (CMP Units). Western Precipitation Corporation.

BOILERS & BOILER ACCESSORIES

231—Steam Generators

The advantages of shop-assembled power for your plant with Type-A water tube steam generators are explained in 8-page bulletin 52-1. Line drawings show the flexibility of design possible and dimensions. The Wickes Boiler Co.

232—Draft Inducers

The biggest contribution to the cause of improved furnace operation in recent years has been the mechanical draft inducer, according to 12-page booklet I-52. Six causes of poor chimney draft are listed. Parts of a typical draft inducer installation are numbered and explained. A selector chart is included. L. J. Wing Mfg. Co.

233—Packaged Steam Generators

Construction of packaged steam generators is described in eight-page bulletin 1050. Auxiliary equipment is listed and a blueprint with dimensions of a typical boiler room is given. Ames Iron Works.

234—Flame Failure Protection

"Guarding Your Properties Against Flame Failure Explosions," booklet CP21, shows how to determine whether your fuel burner is adequately protected against explosion and briefly describes equipment to provide complete protection. Combustion Control Corp.

235—Blow-off Valves

Up-to-date information on blow-off valves for pressures up to 400 lb is given in revised bulletin B426. Lists construction features, specifications, styles and dimensions. Numerous diagrams, tables and photographs give complete details. Valve selector table given. Yarnall-Waring Co.

Pressure Equipment

One of the country's oldest manufacturers of equipment and accessories for plants piping, steam, air and gas under pressure, has published catalog 400, covering its line of separators, traps, and boiler trim. A condensation of the information in catalogs 500, 600, and 700, the booklet gives adequate size and pressure tables and technical data on the most frequently and commonly used equipment. **Please send requests directly to Wright-Austin Co., 3245 Wight St., Dept. IP, Detroit 7, Mich., on company letterhead.**

236—Boiler Baffles

"More Steam from Your Boilers," a four-page folder, explains how streamlined baffles are applied to all types and sizes of the company's boilers. Drawings indicate how they are installed in each specific unit to secure crossflow of gases. The literature also points out how gas passes are tapered in area to obtain necessary velocity for maximum heat transfer. The Engineer Co.

237—Boiler Replacement

"What Every Business Man Should Know About Boilers," has been prepared to give executives a better understanding of boilers and a realization of the tremendous loss that industry is taking due to obsolete and inefficient steam generating equipment. Chances are two to one that your boiler is obsolete, according to this 14-page booklet. The term "packaged steam generator" is explained along with the advantages of using such units. Superior Combustion Industries, Inc.

238—Soot Blowers

Bulletin 1137 gives complete information on the Model G9B blower which employs a fixed position rotating element to clean a large number of tubes by sweeping through a pre-determined arc. The bulletin suggests the various uses for boilers, superheaters, reheaters, economizers, heat exchangers, and oil stills. The blower described is available for three pressure ranges up to and including 1500 psi. Diamond Power Specialty Corp.

239—Off-Center Firing

Design features of a compact, automatic package boiler are discussed in four-page folder EC-1152. The theory of off-center firing, used with these units, is discussed. Specifications for units through 250 hp are tabulated. Dutton Boilers Div., Hapman-Dutton Co.

240—Fuel Systems

Over 50 years of experience in steam generation backs up 29-page bulletin "Pulverized Fuel Systems." Well illustrated with cross-sectional drawings and graphs, it gives advantages, typical installations, and descriptions of major operating parts. Foster Wheeler Corp.

241—Packaged Boilers

Packaged automatic boilers for light oil, heavy oil, gas, or combination gas and oil firing are featured in 16-page bulletin 1219. Ratings for 15 to 500 hp units are tabulated and installations for steam process and steam and hot water service are illustrated and described. Orr & Sembower, Inc.

242—General Catalog

A wealth of research, engineering, and manufacturing experience, gained since the founding of this company in 1880, is incorporated in the products described in four-page folder. Steam generators, heat

NOTE—Each bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 36/37 & 100/101.

transfer equipment, pressure vessels, valves and fittings, and refrigeration equipment are shown. Henry Vogt Machine Co.

243—Boilers

Self-contained boilers for heating and processing are described in seven-page bulletin AD-100. Design is illustrated by a cross-sectional drawing and efficiency is shown by graph. Capacity and dimension tables are included. Cleaver-Brooks Co.

244—Spreader Stoker

Bulletin 897 describes a spreader stoker with overthrow rotors said to provide exceptionally uniform fuel distribution. Sizes and capacities for application to all types and makes of boilers or steam generators are shown in cross-sections and photographs. The units described will burn all grades of bituminous coal, lignite, wood, and refuse separately or in combination with coal. Detroit Stoker Company.

245—Firing Equipment

Over 50 years of leadership in the manufacture of industrial-commercial firing equipment is reflected in 19-page general catalog 3048. Schematic drawings, layouts of typical installations, cutaway views of burners and burner parts, and photographs of burners and installations are included among the many illustrations. Specifications and detailed data on exclusive features of this company's oil, gas, and combination oil-gas burners are given. Petro Division.

246—Cyclonic Combustion

Principles of the patented method of Cyclonic Combustion are explained in four-page folder, "All Your questions Are Answered by Cyclotherm." Descriptive drawings show how air is introduced into the combustion chamber at extremely high speeds in a revolving spiral vortex, radiating heat to the fire tube through direct radiation and convection. Cyclotherm Division of United States Radiator Corp.

247—Three-Drum Boilers

A pioneer in the application of 2½ in. diameter tubes to three-drum boilers describes its Type "C" boiler in revised seven-page catalog SB-49. These high-pressure, high-duty units are shown by means of cut-aways. A table gives specifications. Erie City Iron Works.

248—Vertical Unit Boiler

More than 25 years of development, manufacturing, and application experience are reflected in the design of the Type VU-10 vertical-unit boiler described in 16-page bulletin VU 10-8. Advantages and design features are discussed. Various possible installations are shown by photographs and cross-sectional drawings. Combustion Engineering, Inc.

249—Heavy-Oil Burners

Booklet 175-G, eight pages, describes the outstanding design and construction features of both the Model B oil, and the Model BR oil-gas burners, including dual-pump reservoir, fuel regulator, high-speed belt-drive, precision air-oil control, sure-fire ignition, fuel feed to atomizer, and extra long nozzle. Complete specifications, computed at 70 percent thermal efficiency, are given for both types. Preferred Utilities Manufacturing Corp.

250—Boilers

Six-page catalog 90 illustrates and describes the M-800 Series boilers for high and low pressures and designed for oil or gas firing. Detailed listings of ratings, dimensions, standard equipment, and trim are included. The booklet points out that boilers in this series are ideal for use with any quality oil, gas, or combination oil-gas burner to form a complete boiler-burner unit. Kewanee-Ross Corp.

HEAT

. . . may be the "trouble" with your electrical system

Are you troubled with nuisance power interruptions, insufficient branch circuit capacity, motor burnouts and the accompanying costly production delays? You will probably find that *heat* affecting your protective electrical equipment is the heart of your trouble.

You can eliminate heat considerations, however, simply by replacing with HEINEMANN Circuit Breakers.

HEINEMANN Circuit Breakers do not employ thermal elements or heaters of any type. Thus, their current carrying capacity and all set tripping points are completely independent of ambient temperature . . . unaffected even by nearby furnaces, steam pipes or cold drafts. HEINEMANN Circuit Breakers do not require de-rating. With HEINEMANN, 20 amperes means 20 amperes of usable capacity without needless tripping.

HEINEMANN Circuit Breakers operate on a hydraulic-magnetic principle. They provide inverse time delay to allow starting inrush or harmless, temporary overloads . . . yet they provide the fastest circuit interruption available on large overloads or short circuits.

GET THE COMPLETE FACTS: Send for your copy of "WHAT YOU SHOULD KNOW ABOUT CIRCUIT BREAKERS". Ask for Manual 101.

HEINEMANN ELECTRIC COMPANY
140 Plum Street • Trenton 2, New Jersey

HEINEMANN Circuit breakers

Circle 555 on Reply Card for more data

need information on
structural equipment?

reach for your
Plant Engineering File

"...a great time-saver"

These manufacturers' catalogs are instantly available in Sections 5a, b, c, d, of your Plant Engineering File:

Acorn Wire and Iron Wks.	Maryland Metal Bldg. Co.
Airolite Co.	Moeschl-Edwards Cor. Co.
American Steel Band Co.	P. O. Moore Inc.
American Steel & Iron Works	Neenah Foundry Co.
H. H. W. Bergmann Co.	North American Iron & Steel Co.
Burt Mfg. Co.	Overhead Door Corp.
Colorado Fuel & Iron Corp.	Resolite Corp.
Diamond Expansion Bolt Company	Russell, Burdsall & Ward Bolt & Nut Co.
Dusing & Hunt Inc.	St. Louis Fire Door Co.
Fisher Skylights, Inc.	Security Fire Door Co.
Flockhart Foundry Co.	Stewart Iron Wks.
E. F. Hauserman Co.	Swartwout Co.
Hirschman-Pohle Co.	Unistrut Products Co.
International Steel Co.	E. Van Noorden Co.
Kinnear Mfg. Co.	Ventilouvre Co.
Lawrence Steel Co.	Wheeling Corrugating Co.
Macomber Inc.	Woodbridge Ornamental Iron Wks.
R. C. Mahon Co.	

In other sections of the File you will find additional catalogs containing useful information on a wide range of products used in the maintenance of all plant facilities.

Sweet's Catalog Service

Division of
F. W. Dodge Corporation
**119 West 40th Street,
New York 18, N. Y.**

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bulletins

— Starts on page 102

251—Steam Gage Illuminators

Mercury vapor illuminators for steam gages are the subject of data sheet 196. Unmistakable water level indication is provided by a brilliant green spot at the water level. Jerguson Gage & Valve Co.

252—Automatic Burner

Newly designed automatic burner, model PK-54, for oil, gas, and oil or gas, is described in four-page folder 430. Safety features are listed and the unit's integrated design is explained. For capacities to 42,000 lb steam per hour, the burner is described as a complete, automatic combustion unit including burner, blower, and controls. Peabody Engineering Corp.

BUILDING MATERIALS & MAINTENANCE

253—Iron Cements

Suggestions for simple reliable repairs on equipment and piping using iron cement are presented in 40-page pocket-size pamphlet. Patching cement, aluminum and bronze cement, concrete paint, gaskets and clamps are also presented. Also included is a folder describing advantages and how to apply concrete paint No. 15, for interior or exterior use. Smooth-On Manufacturing Co.

254—Thread Compound

A data sheet gives complete information on C-5 "Hi-Temp" thread compound. A sample will be sent along with the data sheet. Felt Products Manufacturing Co.

255—Maintenance Book

"Genius at Work," is a handy booklet full of ideas for plant maintenance. This company has developed Kroil, a chemical for loosening frozen parts. Kano Labs.

256—Repairs

With the theme "Its wise to economize," four-page folder 805 explains how company's repair department facilities can save you money. Pressure vessels, jacketed kettles, and agitated reactors can be retubed, rebuilt, remodeled or redesigned for new requirements. Manning & Lewis Engineering Co.

257—Flooring

"Hand Book of Building Maintenance," gives valuable information on keeping your plant in efficient working order. Instant-Use concrete floor patch is described with suggestions for its use, along with other materials for repairing floors. Flexrock Company.

258—Pipe Joint Compound

With the literature on this waterproof sealer for pipe joints carrying water, gas, or low-pressure steam, a sample of the compound will be sent. Key Company.

ELECTRICAL EQUIPMENT

259—Dry Type Transformers

How to use dry type transformers profitably in your plant is explained in folder DT 195 which also includes wiring diagrams. Acme Electric Corp.

260—Variable Speed Motors

How variable speed motors are used to improve production is described in 16-page brochure 1797. In addition to describing advantages the booklet describes design theory and construction features. Special controls, including both mechanical and electrical types, also are discussed. U. S. Electrical motors, Inc.

261—Fuses

Hi-Cap fuses for the protection of loads above 600 amp are described in six-page bulletin HCS. Two handy charts are included: Current Limiting Effect and Opening Time Curves. Use of these fuses in conjunction with Fusetron fuses is explained. Bussmann Manufacturing Co.

262—D-C Power

D-c power sources and supplies are described in eight-page booklet B-1049. Mechanical and electrical specifications are given for the Nobratron. Sorenson and Company, Inc.

263—Motors

Advantages of the various types of motors made by this company are given in four-page folder 23. Descriptions of single-phase and polyphase motors are included along with a listing of their specifications. Wagner Electric Corp.

264—Flexible Conduit

Extra flexible Sealtite conduit for electrical wiring of machine tools and industrial equipment is pictured and described in four page pamphlet EF-531. It points out the fact that this liquid-tight, extra flexible conduit is approved for these uses by the Joint Industry Council. American Metal Hose Branch, American Brass Co.

265—Circuit Breakers

"What You Should Know About Circuit Breakers," 16-page manual 101, explains the operating principles of basic circuit breaker design. Included are simplified diagrams of three basic types. Explanations, charts and diagrams deal with temperature factors, inrush current effects, tripping and reset time, quick and slow make-and-break, and wire deterioration rates. Heinemann Electric Co.

266—Commutators and Slip Rings

"Commutator and Slip Ring Maintenance," 39-page handbook, covers trouble shooting, brush maintenance and operating procedure, and general maintenance. Illustrations show the operations described. Ideal Industries, Inc.

267—Conduit and Fittings

Catalog 65, 63 pages, covers the entire line of electrical conduit and cable fittings manufactured by this company. Each product is indexed for easy reference. Tables list current-carrying capacities, dimensions, weights, and decimal equivalents. Thomas & Betts Co.

268—Induction Motor Standards

New NEMA standards for 1 to 40 hp induction motors have been published in seven-page bulletin 1600. A comparison of the principal dimensions of the old and new NEMA frames is included in table form. The Louis Allis Co.

269—Renewable Fuses

Sixteen-page bulletin S-40 describes the Economy De-Lay renewable fuses which are said to give safe and dependable time-delay on overloads. For every requirement, these fuses have inexpensive links which are easily replaced. Economy Fuse & Manufacturing Co.

270—Communication Systems

This data kit describes low-cost communication networks which make it possible to talk from control points to plant and between plant sites. Ease of installation is described along with the many possible arrangements for specific needs. Farmers Engineering and Mfg. Co.

271—Metal Clad Switchgear

The HV line of metal clad switchgear is described in bulletin 7004B. Advanced

engineering, refined design, and quality construction are included in this line according to the bulletin. I-T-E Circuit Breaker Co.

272—Variable Speed Motors

How variable speed motors are used to improve production is described in 16-page brochure 1797. In addition to describing advantages, the booklet describes design theory and construction features. Special controls, including both mechanical and electrical types, also are discussed. U. S. Electrical Motors, Inc.

ENGINES & TURBINES

273—Steam Turbines

Fully-illustrated 24-page bulletin 1961 emphasizes the flexibility of design of the type-S turbine which is said to make possible selection of the proper number of stages, governor, and controls to give maximum efficiency for your steam and operating conditions. Each component of the system is pictured and described. Worthington Corp.

274—Multi-Stage Turbines

Smaller framed, multi-stage turbines are featured in six-page bulletin. Overspeed governor, governor valves, blades, diagrams, and many other design features are discussed and illustrated. The Terry Steam Turbine Co.

275—Diesel Engines

Smaller and lighter, but for heavy-duty service is the description of a diesel engine discussed in 12-page bulletin 10027. Three models are listed, ranging from 200 to 380 hp at 900 to 1000 rpm. Specifications and performance curves are included. Ingersoll-Rand Co.

TO REQUEST FREE BULLETINS

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276—Steam Turbines

Full details of this company's steam turbine are given in bulletin 135. Drawings and installation photographs point out the special features. How to save operating and maintenance costs by buying the right size turbine for individual needs is explained. Coppus Engineering Corp.

277—Steam Turbines

If you use steam for heating, cooking, or processing, you can get power at almost no cost with the use of a Wing steam turbine according to bulletin SW-1a. Construction of these units gives an almost infinite range of speeds, easy control by throttling, and the units are independent of any electric power failure. L. J. Wing Mfg. Co.

278—Turbines

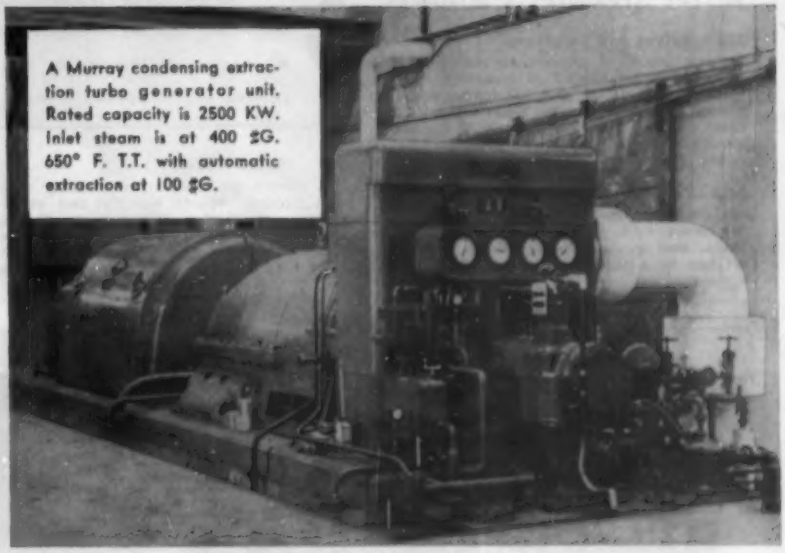
Full details on this company's mechanical drive turbines are presented in a fully illustrated bulletin. These units are described as standard turbines, but "tailor-made" to your requirements. How they can be adapted to practically any operating condition or service is explained. Elliott Co., Steam Turbine Dept.

FANS & BLOWERS

279—Propeller Fans

Three new models are among the 13 types of fans shown in 40-page bulletin A-109. It also describes three types of roof ventilators, unit heaters and intake air units, and includes specifications, dimensions, and performance figures on all

Murray Turbines



A Murray condensing extraction turbo generator unit. Rated capacity is 2500 KW. Inlet steam is at 400 #G. 650° F. T.T. with automatic extraction at 100 #G.

● Murray Turbo Generator units can be furnished to meet your special requirements in sizes up to 3000 KW. Condensing and non-condensing types with or without extraction and/or mixed pressure features can be furnished. Whether you require a small inexpensive standby unit or a highly efficient, and reliable source of power, Murray has a design to fit your needs.

Consult your local Murray representative who will gladly help you select the unit most economically suited to your conditions.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY

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bulletins

— Starts on page 102

of the equipment plus valuable engineering data. A special feature is a discussion of corrosion-resistant materials and coatings which includes a table showing the suitability of special materials and coatings for use for a wide variety of fumes commonly encountered in industrial installations. Hartzell Propeller Fan Co.

280—Axial Fans

This 38-page catalog, B-1013, is designed to acquaint the user with axial fans. Technical data furnished permits the proper selection of types and sizes. Physical dimensions are shown to assist in preparation of preliminary layouts. American Blower Corp.

FILTERS, STRAINERS & PURIFIERS

281—Valves and Strainers

Forty years of service are behind the information presented in bulletins 128-A (pipeline strainers) and 228 (pressure reducing valves). Cross-sections, tables, and diagrams are used to point out the advantages of this company's products. McAlear Manufacturing Co.

282—Twin Strainers

Twin strainers for filtering foreign matter from oils, grease, tar, glue, sugar juice, and similar viscous fluids are described in 4-page leaflet, A-17. They are available with inlet sizes from 1 through 10 in. for working pressures to 500 psi. Elliott Co., Accessories Dept.

HEAT EXCHANGERS & WATER HEATERS

283—Temperature Control

A simple method of controlling the temperature of liquid or gas is explained in four-page folder 120 on heat exchangers. Cutaway drawings illustrate how the units operate and flow diagrams show how controls keep a fluid at uniform temperature. Niagara Blower Co.

284—Heat Transfer Equipment

Various types of heat transfer equipment are among the products described in 12-page catalog 12. Also presented are various types of dry blending equipment and such process equipment as kettles, evaporators, vessels, reactors, and coils. The Patterson-Kelley Co., Inc.

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285—Water Heaters

A streamlined system of heating water and process liquids quickly and at low cost is explained in this bulletin. The Instant Heater described eliminates the need for reducers. Cross-sectional drawings explain how the unit operates. Johnson Corp.

286—Instantaneous Water Heater

Answers to your hot water problems are given in booklet "Methods and Means." Operation and advantages of the instantaneous water heaters as compared to the indirect method heater are discussed and illustrated. Pick Manufacturing Co.

HEATING, AIR CONDITIONING, & REFRIGERATION

287—Heating Specialties

How to design a one-pipe hot water system is explained in eight-page booklet J-355. In addition to discussions, data tables and diagrams are included. Many types of heating specialties are described, including a circulator, flow valves and fittings, relief valves, vents, a charging valve, compression tank. The Trane Co.

288—Electric Comfort Heaters

Listed in eight-page catalog D-52 are 75 different models of forced air, convection, and radiant heaters in capacities of ¼ to 100 kw. Aids include a quick selector chart which shows how to calculate heat requirements for given areas and types of buildings. Edwin L. Wiegand Co.

289—Unit Heaters

Catalog CUH 846-A gives the complete story on Grid unit heaters. Catalog BC-1040 describes Grid blast coils for process drying. How the construction of the unit heaters prevents electrolytic corrosion is explained in booklet "Corrosion in Unit Heaters." D. J. Murray Manufacturing Co.

290—Air Conditioner

Precision control of air temperature and moisture enable you to produce your product in any climate, at any season, according to six-page bulletin 122. The Type "A" air conditioner described, for drying or moistening of air, is shown in typical installation photographs. A cross-sectional drawing points out operation and advantages of unit. Niagara Blower Co.

INSTRUMENTS & CONTROLS

291—Instrumentation

Illustrated eight-page booklet R-8, "Results," presents the case history of a large independent electric power producer. In addition to discussions of the use of steam, fuel and ash handling, and plant steam demand, the combustion control system is fully described. The Hays Corp.

292—Measuring Devices

Information on more than 115 testing and measuring devices are contained in 64-page catalog GEC-1016A. A brief description of each product and its field of application, condensed tables of important characteristics, and prices indicate whether or not the instrument is suited for a specific job. Products range from simple current indicators to completely automatic oscillographs. General Electric Co.

293—Flow Meters

With an alarm control, the flow meters described in this bulletin have only three moving parts. How it operates to ring a bell, light a light, or activate a motorized valve is explained by means of illustrations. Henszey Co.

294—Level Control

Bulletin PC-37 describes floatless level control unaffected by surface agitation or equipment vibration. Drawings show typical installations and details of operation. Leslie Co.

LUBRICANTS & LUBRICATION EQUIPMENT

295—Lubricating Oil

Excellent time-temperature characteris-

Two heaters and two pumps—one steam, one electric driven—in one set with these six features:

1. Completely automatic operation with temperature and pressure regulation.
2. All essential equipment—including safety valves as needed—in one compact unit.
3. Individually designed to meet the specific needs of the power plant.
4. All parts visible and accessible for easy operation, maintenance and repair.
5. Pumps run at moderate speed. Heaters designed to give the correct viscosity and velocity without fouling.
6. Cleaner boiler room . . . all overflows connected to a common outlet, flanged drip pan for pumps catches oil drip.

EC490

THE ENGINEER COMPANY
75 WEST STREET, NEW YORK 6, N.Y.
IN CANADA: ROCK UTILITIES LTD., 80 JEAN TALON ST. W., MONTREAL, P. Q.

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tics, and application by any method are advantages listed in technical data sheet 17, for newly developed lubricating oils. Physical properties and other advantages are discussed, and a chart shows service life characteristics. Sun Oil Co.

296—Force Feed Lubricator

High pressure force feed lubricators, designed for service at pressures to 30,000 psi, are dealt with in 12-page catalog 25G. Tables show output, dimensions, and specifications. Information is given on how to order the correct unit and fittings. Manzel Div., Frontier Industries, Inc.

297—Oil Reclaimer

Subject of four-page folder R-247 is a self-contained, compact oil reclaimer for keeping industrial oils free from contaminants. In addition to describing how the process works, the bulletin suggests applications. The Hilliard Corp.

298—Lubrication

The answer to the problem of securing maximum over-all efficiency in lubrication lies in determining the kind and quality of the lubricant, and the method of application that is best suited to each case. This 43-page handbook will help you select the lubricant for your particular needs. Recommendations are given for a wide variety of applications. Lubriplate Div., Fiske Brothers Refining Co.

299—Lubricant

This instructive bulletin explains the uses and advantages of Non-Fluid Oil. According to this booklet, it cannot clog fittings, it lubricates until entirely consumed, and will not separate under pressure. A free testing sample of the oil will be sent with the literature. New York & New Jersey Lubricant Co.

MATERIALS OF CONSTRUCTION

300—Nickel Alloys

Helpful technical publications covering the many aspects of nickel alloys, and their applications, are listed in two bulletins. Instructions on how to order literature, free of charge, are included. The International Nickel Co., Inc.

MATERIALS HANDLING EQUIPMENT

301—Storage Systems

"Modern Industrial Storage Systems," 12-page brochure 4393, discusses the subject of storage of raw ingredients, semi-processed, or finished material. The flexibility and adaptability of concrete silos is discussed. Descriptions of component parts and construction are supplemented with line drawings. Marietta Concrete Corp.

302—Conveyor System

How a recently installed interfloor-conveyor system cut receiving-to-storage time is discussed in a reprint. The article tells how the system eliminated a long truck haul, stopped elevator congestion, and reduced unloading time of highway trucks. Included are descriptions of the vertical interfloor conveyor, feeder conveyor, take-away conveyor, and automatic control system. Gifford-Wood Co.

303—Coal Handling Equipment

Applications of coal handling equipment for the power plant, pictured in 40-page brochure 2410, illustrate the cumulative experience gained in thousands of installations over more than 75 years. Drawings show tested layouts for various operating conditions. Link-Belt Co.

MECHANICAL POWER TRANSMMISSION

304—V-Belts

Fractional horsepower V-belts, for use

NOW

Roll tubes into thick tube sheets automatically! . . . from the inside out! with the NEW AIRETOOL RETRACTIVE EXPANSION SYSTEM

Advantages? *just check them!*

- √ Draws tube metal toward mouth, eliminates inward elongation.
- √ Each joint rolled automatically to predetermined tightness.
- √ Eliminates slow, costly steprolling.
- √ Continuous process rolling shortens rolling time.
- √ Tube sheets protected against distortion, enlargement of holes.

With this new Retractive Method of Tube Expansion, the expander is fully inserted and rolls a short section of the tube. When full expansion is reached, it then automatically starts to retract. Keeps rolling as it retracts, gives full expansion to the tube the entire thickness of the sheet.

To learn more about this efficient new Retractive Method of expanding high pressure tubes—write for your copy of AIRETOOL Bulletin No. 54.

AIRETOOL MANUFACTURING COMPANY SPRINGFIELD, OHIO

There's an AIRETOOL Tube Cleaner and Tube Expander for Every Type of Tubular Construction.

Branch offices: New York • Chicago • Philadelphia • Tulsa • Baton Rouge • Houston • Hudson Heights (NJ)

Representatives in principal cities of U.S.A., Canada, Mexico, South America, England.

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bulletins

— Starts on page 102

in servicing light duty applications, are cataloged according to the new industry-standard numbering system. Various types of machines are listed alphabetically by company or trade names for convenience in determining the proper belt. Manhattan Rubber Div., Raybestos-Manhattan, Inc.

305—Steel Collars

Steel shaft collars are shown in use on industrial lift trucks, printing presses, textile machinery, and other industrial equipment. Advantages of this type of collar are listed and a specification table is included. Standard Pressed Steel Co.

306—Power Transmission

Power transmission products to meet the requirements of today's machinery and production are described in an eight-page catalog. Advantages of special construction features are pointed out by means of cross-sectional drawing and text. Specifications are listed for easy reference. Lovejoy Flexible Coupling Co.

307—Eddy-Current Machinery

"Basic Principles of Eddy-Current Machinery," a section of 16-page bulletin GB1, explains the fundamental principles of generating torque by means of eddy-current devices. Another section, "Characteristics of Rotating Equipment," contains engineering data. Descriptions are included of typical eddy-current equipment such as adjustable speed drives and couplings. Dynamatic Corp.

308—Rayon Belting

Transmission belting with rayon instead of cotton plies was proved in field applications for more than four years on jobs specially selected for their severity according to four-page folder A5163K. Uses and advantages of the several types of Thor belting are listed. Goodyear Tire & Rubber Co.

PACKING & GASKETS

309—Metallic Packings

Included in an eight-page leaflet are service recommendations for "V" metal insert packings, metallic valve stem, plastic core metallic face, all metallic, flexible metallic, high temperature aluminum, and braided copper packings. Standard sizes, packages, and approximate weights for each type are also listed. Raybestos-Manhattan, Inc., Packing Div.

310—Packings

Darcova pumcups, which permit equipment to be operated at reduced speeds, are described in two bulletins: No. 4502 on Pumcups for air or hydraulic mechanisms; and 4401 on units for reciprocating pumps. How these units decrease maintenance and lower operating costs is described. Darling Valve & Mfg. Co.

311—Power Plant Applications

How to get the best results from packings is outlined in useful 6-page folder PK-61-A entitled, "Packings for the Power Plant." Each of 28 types of packings and gaskets is illustrated, briefly discussed and numbered for quick reference. These numbers are then used on a schematic drawing of a power plant to indicate recommended applications. Johns-Manville Corp.

PIPE, TUBING & HOSE

312—Prefabricated Conduit System

Introduced in four-page folder 5210 is a newly developed large diameter, prefabricated conduit system for protection of underground services. Prefabricated to job requirements, it contains piping for steam, condensate, water lines, fire lines, or process purposes all in place and insulated where required. Also included are traps, valves, and expansion devices. The literature explains how the system is installed and stresses simplicity of making joint connections. The Ric-wiL Co.

313—Pipeline Expansion

Catalog 135, 24 pages, is packed with engineering applications and selection data necessary to the proper solution of pipeline expansion problems. The center spread is devoted to a schematic piping layout illustrating expansion joint applications and principles. Flexonics Corp.

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314—Rubber Linings

Application of rubber lining to prevent corrosion of tanks, pipes and valves is discussed and illustrated in 4-page folder. In addition, a 2-page reprint tells how rubber lining can stop circulating pipe corrosion. La Favorite Rubber Manufacturing Co.

315—Piping Layout

How to plan an industrial waste treatment system is described in "Piping Layout No. 70." The booklet includes diagrams, specifications, and other detailed engineering data. Jenkins Brothers.

316—Flexible Metal Hose

For what purpose do you use flexible metal hose? Whatever your application, you will find valuable information about job tested and certified hose in catalog 500. Included are data on steel, stainless steel, monel, and bronze hose in sizes 1/3 to 36 in. ID. Atlantic Metal Hose Co.

317—Pipe Hangers

This hanger catalog describes the complete line of adjustable pipe hangers and supports made by this company. Specifications, drawings, and engineering data are included. Grinnell Company, Inc.

318—Universal Joints

Universal joints available in 13 standard sizes—½ to 4 in. dia and bore, 2 to 10⅝ in. lengths—are described in this catalog. Advantages such as maximum strength and bearing surface, and optimum operating angle are explained. Lovejoy Flexible Coupling Co.

PUMPS & COMPRESSORS

319—General Catalog

Equipment for buildings and institutions is the subject of 20-page bulletin WP-1099-B27M. Condensed information is provided on such equipment as air conditioning and refrigeration products; oil, gas and dual fuel engines; deaerators and deaerating heaters; water conditioning; steam turbines and turbine generators; liquid meters; centrifugal pumps; regenerative

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Positive, Tight Closure—even air or bubble tight.
Automatic Control—electric, air, hydraulic, float, solenoid, etc. Or manual control, if desired.
Pressures—to 300 p.s.i. and higher.
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Materials—made of any metal or rubber lined.
Sizes—from 1" to 120" diameter, and larger.

We also manufacture wafer type butterfly valves; slide and gate valves; proportioning valves; swing check valves. Write for Catalog.

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Butterfly valve with outboard roller bearings, electric motor operator and auxiliary handwheel control, for high velocity air at 125 p.s.i. and temperatures from minus 20° to plus 200° F.

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turbine pumps; vertical turbine pump; and multi-V drives. Worthington Corp.

320—Opposed Impeller Pump

How opposed impellers balance axial thrust is covered in 12-page brochure 1502. Sizes from 2 to 4 in., with 2 to 8 stages, are presented for capacities to 1000 gpm, pressures to 1200 psig, and temperatures to 350 F. Typical applications are tabulated. DeLaval Steam Turbine Co.

321—Pump Valves

Pump valves and graphite packings are delineated in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order, and dimensions are included. Heaters for heating water by blending with steam are also presented. Sims Pump Valve Co., Inc.

322—Turbo Pump

Each component of the type DE turbo pump is pictured and its design advantages explained in a six-page folder. The lubrication system is also described in detail. Typical uses are listed. The J. S. Coffin, Jr., Co.

323—Proportioning Pump

An explanation of the operation and advantages of reciprocating mechanical drive metering and proportioning pumps is given in 20-page brochure UP-52. Technical information on how to select the proper unit as well as service recommendations for handling over 300 substances is presented. Hills-McCanna Co.

324—Vertical Pumps

"Vertical Pumps for Volatile Fluids," six-page folder 1026, appraises the advantages of vertical turbine pumps for handling such liquids as gasoline, diesel fuel, crude oil, L-P gases, and ammonia. Efficiency curves also are included. Johnston Pump Co.

325—Compressors

Two-stage air-cooled compressors for stationary or semi-portable use are described in 11-page bulletin 750. Photographs and cross-sections point up the special features of the units which are arranged for belt-drive, coupled, or "built-in" motors. Chicago Pneumatic Tool Co.

326—Non-Clogging Pumps

Type U non-clogging pumps designed for handling liquids carrying large amounts of solids and foreign materials are described in 11-page bulletin 730-C. The specific uses of each type pump are given along with tables to help in selection. Cross-sectional drawings are used to present special features of different types. Weinman Pump Manufacturing Co.

327—Pump Package Systems

This catalog describes pump package systems including welded steel tanks in standard sizes of 50, 100, 175, 250, and 500 gal complete with all accessories. The Manajust Stroke adjustment for varying capacity when pump is not operating, and the Autajust for precise control of flow while pump is running are explained. Orchem Pump Div.

328—Pumps

Condensed catalog "M" describes pumps for every purpose. Among those described are: turbine type pumps for use with small capacities and high heads; and type 66U side suction centrifugal pumps. Aurora Pump Co., Div. of New York Air Brake Co.

329—Chemical Feed Pumps

Chemical solution feed pump, Model S, for such uses as fluoridation of municipal water and chlorination of industrial wastes is described in four-page folder PM20. Performance, installation, and general applications are outlined. An installation diagram is included. Precision Machine Co.

when power fluctuations affect processes . . . you NEED SORENSEN AC line regulators

here's a case where installing a SORENSEN AC REGULATOR saves $$$ in an RF gluing process

Timber Structures, Inc., of Portland, Oregon, are the largest producers of engineered timber structures in the country. RF is used for pre-gluing scarf joints of lumber to be laminated into very large arches, and also for gluing the firm's "Timberib" barn rafters on a mass production basis. The RF presses were developed by Timber Structures, Inc., engineers.

Voltage to the four RF generators varied greatly due to constantly changing loads throughout the plant. The serious fluctuations necessitated the repair of 5% of total output and scrapping of another 5% as total loss. Unsuccessful attempts were made to remedy the condition through the use of additional and separate service transformers.

The local Sorensen representative surveyed the situation and recommended installation of a 15KVA Sorensen Regulator. The result—complete elimination of product loss or damage through erratic voltage.

The installation was made nearly five years ago. Since then — complete satisfaction! The only service required by the Sorensen Regulator during this period has been the installation of one set of new tubes.

We know that a great many manufacturing difficulties are caused by line fluctuations, most of which could be eliminated quickly and economically by Sorensen AC Regulators. Find out more about this, at no obligation, from your Sorensen representative — write us for his address. Sorensen & Co., Inc., 375 Fairfield Avenue, Stamford, Conn.

SORENSEN

SORENSEN AND COMPANY 375 FAIRFIELD AVENUE, STAMFORD, CONN.

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bulletins

— Starts on page 102

330—Compressors

Horizontal heavy duty air and gas compressors, type T, are described in 15-page bulletin 728-8. Cross sections of crankshaft, inlet valve unloading system, compressor cylinder and valves, and the complete compressor add to the value of the booklet. Also included are brief descriptions of other arrangements of type T compressors. Chicago Pneumatic Tool Co.

REFRACTORIES & INSULATION

331—Refractories

Charts which show at a glance the properties of refractory castables, plastics and mortars are featured in 20-page catalog R-22. Important information including recommendations for each is presented. Photos depict application and end results. The Babcock & Wilcox Co., Refractories Div.

332—Refractories & Insulation

Catalogs R-52 through I-93, compiled in a binder, form an illustrated 40-page booklet showing where, when, and how to use various types of materials for industrial heat generation and processing equipment. An index is included for quick reference. Refractory & Insulation Corp.

333—Heat Resistant Concrete

Useful engineering data and information pertinent to the structural design of refractory and heat-resistant concrete is contained in illustrated 12-page booklet PP-5M. Subjects such as strength, volume changes, methods of reinforcing, sprung arches and domes, application to ducts, and stack linings are dealt with. Universal Atlas Cement Co., Lumnite Div.

334—Industrial Insulation

"J-M Products for the Process Industries," eight pages, is arranged as a ready reference for men responsible for the design, installation, and operation of process equipment. It gives concise data on the properties of the various products and includes photographs showing typical installations. Johns-Manville Corp.

STEAM SPECIALTIES

335—Thermostatic Steam Traps

Balanced pressure thermostatic steam traps for pressures to 300 psi and capacities to 36,500 lb condensate per hr are discussed in four-page folder 250-A. Construction details, operating principle, advantages and maintenance are discussed and illustrated with photos and cutaways. Screwed strainers are also briefly presented. Sarco Co., Inc.

336—Trapping Practices

Engineers concerned with steam traps should find 48-page catalog J a valuable source of data on recommended trapping practice. In addition to explanation of how to calculate condensate loads and select traps, a maintenance section covers installation, preventive maintenance, trouble shooting, and repair. Armstrong Machine Works.

337—Steam Traps

Catalog 68G, 31 pages, describes and illustrates steam traps, strainers, regulating and reducing valves, separators, and vacuum and lifting traps. Included are applications, dimensions, and a handy steam properties table. Strong, Carlisle & Hammond Company.

338—Welded Floats

Units made of stainless steel, monel, and chrome plated steel, in spherical, elliptical, and cylindrical shapes are shown in eight-page bulletin 753. Sizes from 2 to 14 in. dia for pressures from vacuum to 4800 psi are listed with weights, buoyancies, and collapsing pressures. W. H. Nicholson & Co.

339—Separator Catalog

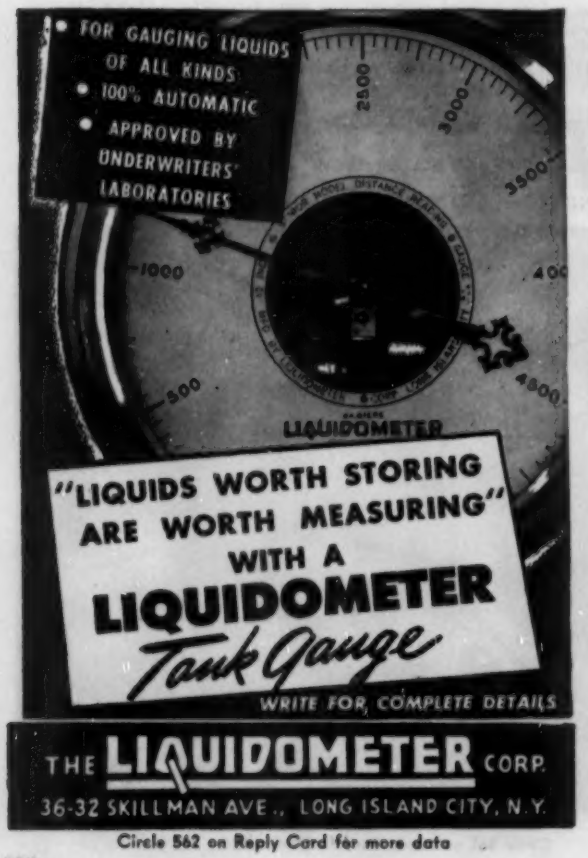
Instead of working out long equations and formulas you can, with the help of four-page bulletin 201, look at a graph and decide the size Hi-eF Purifier to meet your operating conditions. Specifications and applications of these line-type purifiers are also given. V. D. Anderson Co.

340—Float Traps

If you are planning to install low, medium, or high pressure float or float and thermostatic traps, you will need this illustrated catalog sheet. According to the data sheet, once these valves are installed, there is no necessity for the breaking of any pipe connection for cleaning or repairing. All working parts are made readily accessible by removing the cover of the trap. Hoffman Specialty Manufacturing Corp.

341—Steam Trap

The Drainator steam trap with no moving parts is described in this illustrated bulletin. Advantages, such as the fluctuating gage glass which signals when the trap is functioning properly are discussed. Coe Manufacturing Co.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• 100% AUTOMATIC
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Bulletin 330 describes this simple, dependable control.

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342—Trap Selector

Handy, 20-page bulletin T1750 lists common industrial and process equipment and shows how to select proper size trap for each type. Tables show trap capacities, factors of safety, and pressure conditions. Yarnall-Waring Co.

343—Condenser Tube Inserts

How to restore leaking condenser tubes to service by sealing off the deteriorated portion with inserts, is the subject of four-page leaflet 500. Tube cleaners, expanders, and maintenance tools are listed. Thomas C. Wilson, Inc.

344—Tube Cleaners

Equipment for practically every tube cleaning operation is presented in 28-page catalog Y-20. Specifications for cutter heads, drills, brushes, and motors are listed in illustrated tables for quick reference. Cutaways show design features of air, steam, water, and electric powered motors. Accessories are also presented. Sections on care and operation of tube cleaners and table of inside diameters for tubes and pipes add to the booklet's value. Elliott Co., Lagonda Div.

345—Tube Cleaners

Bulletin 43 introduces a new geared tube cleaner for removing scale in heat exchanger and condenser tubes of ⅜ to 2½ in. ID. The unit is said to be particularly effective where conditions require low speed and extreme power. The publication describes various types of drills available for use with this unit. Other features include a flushing system which insures a cool drill while removing scale. The Airetool Manufacturing Co.

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Torque Wrenches

Both inch-pound and foot-pound torquers are described in this complete 68-page catalog. Types included are for a wide range of drive sizes with plain or ratchet head. **Please send requests directly to Proto Tool Co., Dept. IP, 21762 Santa Fe Ave., Los Angeles 54, Calif., with 10c.**

347—Tube Expanders

Rolling and flaring tube expanders and operating accessories are listed in illustrated 8-page catalog 68. General information, specifications, and recommendations are included. A useful guide for ordering is also presented. The Gustav Wiedeke Co.

VALVES & REGULATORS

348—Valves

The various types of valves made by this company are pictured by means of blue-print drawings, cross sections, and photographs in bulletins 500—505, 508, and 600. Complete dimensions are listed in tables. W. S. Rockwell Company.

349—Temperature Regulators

Bulletin 330 fully describes a simple, self-operating temperature regulator for plating, anodizing, bonderiz'ng, pickling, cleaning, and rinsing solutions. The Powers Regulator Co.

350—Flow Meters

Important data on the Diaflow Meter, for measuring air flow, gas flow, and the ratio between the two flows, are presented in eight-page booklet 52-1017-37. According to the booklet, the meter is particularly well suited for industrial furnaces

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More than sixty years of WIEDEKE Quality

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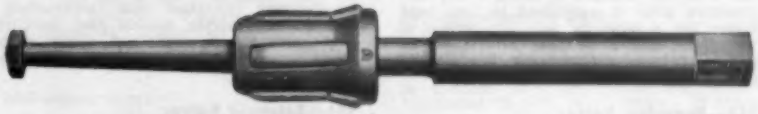
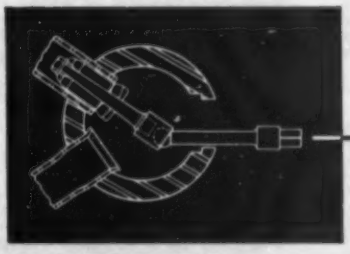
. . . For rolling and flaring Tubes in Super-heater Headers. Now available for Tubes as small as ⅝" diameter.





Tube Expander, Short Mandrel and Joint Drive pinned together in one compact unit, assures easy entry and withdrawal. SAVES TIME—Expander or Parts will not fall away.

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HENSZEY FLOW METERS *with Alarm Control*

RINGS A BELL—LIGHTS A LIGHT or ACTIVATES a MOTORIZED VALVE

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Easy to set on face of switch — unaffected by dust, dirt or corrosion — no pitting or sticking.

HENSZEY COMPANY

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bulletins

— Starts on page 102

and sewage disposal plants. The Hays Corporation.

351—Regulating Valve

How control function of a pilot-operated valve can be changed by using a different sensitive pilot is explained in four-page folder 700. A large cutaway illustration of the valve and a detailed description of design features are included. Spence Engineering Co., Inc.

352—Reducing Valves

Four-page folder 511-A lists actual small flow reducing valve capacities based on test data. Cross-sectional-drawings show construction of the bronze and steel valves. Leslie Co.

353—Cast Steel Valves

Booklet 12-C, 56 pages, contains information on material specifications, preparation of welding ends, flange facings, and pressure-temperature ratings. Construction and specifications for globe, angle, and check valves in 300, 600, 900, and 1500 lb pressure classes are given. Also discussed are parabolic disk valves for hand or motor control of volume. Edward Valves, Inc.

354—Regulating Valves

Bulletin 1-A, 52 pages, gives complete information on a wide range of regulating valves for steam, water, air, gas, or oil. Illustrations, cross-sectional drawings, and specifications are included. Atlas Valve Co.

355—Valves

Catalog 10 describes List 900 and 990 valves. The 900 is for a pressure range of 2000 lb at 100 F to 380 lb at 1000 F. The 990 is for higher pressures. According to the booklet, these valves offer extra protection against excessive stress with extra-strong stem and wedge-gate connection. Chapman Valve Manufacturing Co.

356—Rubber Lined Valves

This bulletin on rubber lined gate and check valves uses cross-sectional drawings to describe operation and construction. The fully revolving double disc, parallel seat principle is explained along with other advantages. Darling Valve & Manufacturing Co.

346—Solenoid Valves

Such solenoid valve specialties as single step valves, two step valves, normally open or closed valves, three and four way valves, and remote control valves are described in 20-page booklet 700. Applications, service, operation, and construction are presented for each unit. Tables list specifications. Davis Regulator Co.

WATER TREATMENT & WASTE DISPOSAL

357—Water Analysis

Published by a company engaged exclusively in the solution of industrial water conditioning problems, this 14-page brochure contains brief descriptions of testing and control equipment necessary for the more common water analyses. W. H. & L. D. Betz.

358—Water Clarification

Major advantages of the solids contact principle for clarifying and lime softening of water, and basic requirements for sound solids contact reactor design are incorporated in 24-page bulletin 5001-A. It illustrates the basic reactor types that can be supplied by this company—round or square units with vertical shaft agitator, and rectangular units with horizontal shaft agitator. Reactors can be made of concrete, steel, or wood or combinations of these materials. Chemical feed and auxiliary equipment are described. Cochrane Corp.

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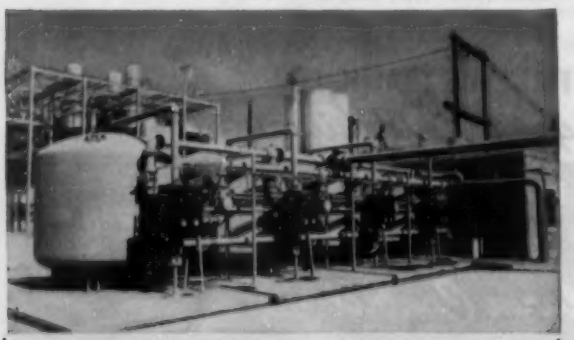
359—Water Purification

"Boiler Feedwater Treatment," 19-page bulletin BFT-1, covers Inversand zeolite softeners, cold process chemical softeners, and demineralizing units, including silica removal by ion-exchange. Each process is explained by means of chemical formulas and flow diagrams. Photographs and cross-sections of equipment are included. Hungerford & Terry, Inc.

360—Ion Exchange Material

Strongly basic anion exchanger is presented in 16-page bulletin 57. Includes complete data on physical characteristics, exchange capacity and regeneration technique. Tables and graphs along with discussions explain performance under various operating conditions. National Aluminate Corp.



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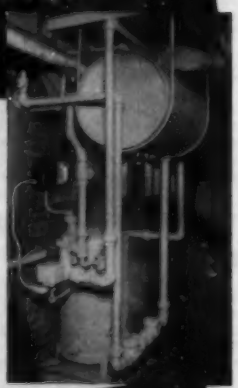
END FLASH LOSS and COOLING LOSSES...

. . . in handling condensate from high pressure processing equipment



Here's the system, engineered around the Johnson Electrap, that gets high temperature condensate back to boiler room with all heat units still intact. In contrast with the usual pump and receiver installation, it eliminates the losses that come with unrestricted flashing of condensate and the addition of cooling water. In many cases this can mean direct savings of 10% and more in fuel and power.

New Data Book has complete engineering information; write for copy today.

The Johnson ELECTRAP for Pumping Service

The Johnson Corporation

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361—Water Treatment

Laboratory pictures in this four-page folder show how Concentrol controls boiler water foam. Examples of its use in various industries are given along with an explanation of foaming. Bird-Archer Co.

362—Water Conditioning

Conditioning for boiler, process, and general applications is discussed in 20-page booklet 611A. A zeolite unit for manual and automatic operation is featured. In addition, chemical feed, zeolite-post treatment, zeolite-alkalinity neutralization, split-stream, and anion exchange dealkalization systems are explained. Elgin-Refinite Div. of Elgin Softener Corp.

363—Water Treatment

"Industrial Water Treatment and Engineering Service," tells of the five basic lines of defense to guard against difficulties in water and steam cycles. A two-page diagram shows a water and steam cycle power plant layout and indicates the usual tests required on samples taken at given points. Dearborn Chemical Co.

364—Ion Exchangers

This 14-page booklet reviews generally the subject of ion exchange, established and potential applications. It gives advantages of the synthetic ion exchange resins and a bibliography of papers concerning their use. Rohm & Haas Co.

365—Water Softening

Bulletin WC-100, 12 pages, explains the distinction between the sodium and hydrogen cycle, and shows differences in results obtained by the two processes. Design and operation of zeolite equipment is described, and available methods for controlling various operations are discussed. A simple method of sizing such softeners and a table of recommended flow rate aids are given. Graver Water Conditioning Co.

366—Boiler Water Treatment

Difficulties caused through industrial water contamination are outlined in a 12-page catalog. Recommended water conditioning treatments for scale, sludge, corrosion, carryover and other boiler conditions, and efficient control methods are described. Details on a system of complete boiler water conditioning are fully explained. E. F. Drew & Co., Inc.

367—Deaerator

Bulletin 4643 contains complete details of a high efficiency deaeration unit for small and medium size power plants. Various types of installations are described along with the accessories necessary. Cochrane Corp.

368—Deaerators

Spray-atomizing type units are shown in cross-section in four-page booklet 400. Function, design and operation, construction, outstanding features, and uses are discussed. American Water Softener Co.

369—Waste Treatment

How this company has solved waste treatment problems for such industries as electro-plating, refinery, gas, and metal finishing is treated in detail in six-page booklet 70-B. Cross-sections show the various types of chemical and biological treatment equipment. A handy bibliography serves as a reference for more information on waste treatment in each of the industries covered. Infilco, Inc.

370—Chlorinizers

Chlorination—the modern way to prevent slime buildup in condensers and heat exchangers—saves you money if its right. But if dosage is too heavy, you run the risk of corrosion, according to application memo 840-J9. Chlorinizers available in three volumetric models for feeding from a few pounds to 6000 pounds per day are described. Builders-Providence, Inc.

371—Ion Exchange

"Demineralization Including Silica Removal by Ion Exchange," 28-page booklet 3803, describes applications, principles of operation, design features, and advantages, and gives recommendations and specifications for demineralizing and silica removal apparatus and synthetic resins. The Permutit Co.

372—Combustion Data

"Industrial Combustion Data," a 168-page handbook on heat processing applications, gives useful technical data arranged in concise, practical form, and amply illustrated. It will be of interest to those who are concerned with the selection, supervision, operation and maintenance of oil and gas combustion equipment as applied to industrial furnaces, ovens, kilns, driers, heaters, kettles, stills, calciners, and other similar equipment. Hauck Manufacturing Co.

MISCELLANEOUS

373—Blast Cleaning Machines

Two fundamental methods of applying abrasives with hand-operated, nozzle, blast cleaning machines are appraised in 28-page booklet 100A. In addition, applications for both wet and soft abrasives are discussed. Design features, construction, and operation of various types of blast cleaning hose machines are described. Tables indicate the relationship between orifice area, circumference, nozzle sizes, air flow, and required horsepower. Pangborn Corp.

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GIVES 6 LUBRICATION EXTRAS

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ALL SIZES TO FIT YOUR WATER GAGES

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Send for Catalog LIVINGSTON, N. J.

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3½" bar or larger, floor type.
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POWER ENGINEER WANTED

POWER ENGINEER—To take charge of industrial power plant burning pulverized fuel; non-condensing turbo-generators. New Jersey first-class license required. Write stating age, experience and salary. **BOX No. C2 Industry and Power, St. Joseph, Mich.**

AVAILABLE REPRINTS

SPECIAL REPORT REPRINTS

"Industrial Development Review," Jan. 1954
"Control Valves and Positioners," March 1953
"Adjustable Speed Drives and Electrical Controls,"
"Combating Corrosion From Ind. Chemicals"
"Packaged Electrical Distribution Equipment,"
"Contaminants in the Air," Jan. 1952

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"More Power For Jamestown," Dec. 1953
"Coal Handling at Elrama," Dec. 1953
"New Water Tube Package Boiler," Dec. 1953
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five-cu-ft capacity, was installed to mix alkaloids in the manufacture of a well known analgesic. This unit replaced a hand-mixing method in which about 20 lb of components were mixed in open containers for an hour.

The small blender handled 80 lb per batch, produced a uniform blend in 20 min, and eliminated exposure of the operator to the sedative effects of the drug.

The second installation, a 30-cu-ft unit, handles the mixing of sodium ascorbate in batches of 1650 lb per blending operation.

Carbon-Bonded Spouts Last Three to Four Days

Carbon-bonded silicon spouts developed for a new western copper refinery are helping to maintain continuous 24-hr per day production of horizontal cast copper wirebars.

Conventional refractory spouts require constant repairs to obtain a life of 24-hr. The new spouts, conceived by engineers of the copper company and Electro Refractories & Abrasives Corp., last from three to four days of continuous service during which time little repair work is required.

They resist the wetting action of the cuprous oxide present in molten tough pitch copper, thus preventing metal or slag penetration and the resultant destruction of the refractory. The spouts maintain their original size so that four individual streams of molten copper may be delivered into individual molds at a definite and uniform rate of flow. Due to the lower thermal conductivity of the carbon-bonded silicon carbide no external heat is required to maintain the temperature of the ladle spouts between pours. External heat was essential when spouts were made of silicon carbide but not carbon bonded.

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★ all piping and wiring, ready for your service connections.

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✔ prevents stud breakage
✔ eliminates pitting of stainless steel

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Thermodynamic
STEAM TRAP

ACTUAL SIZE

this new trap virtually eliminates maintenance

SOLID STAINLESS STEEL DISC ACTS AS VALVE HEAD

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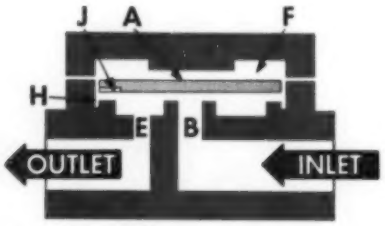

Air and or condensate raise valve seat disc A, discharge thru E. When steam follows, greater velocity causes it to strike body at H thus building up pressure in chamber F. This causes disc to seat, closing tube B. As pressure in F decreases by condensation and leakage thru slot J, pressure in tube B raises disc and cycle is repeated.

The Sarco Thermodynamic Trap has proved successful on steam mains and separators; headers and soot blower pipes; engine and turbine stop valves, separators and casing drains; alternate heating and cooling applications.

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Check these advantages to your own satisfaction at absolutely no cost. We'll send you a trap for free trial. All you do is fill out the coupon and mail it in.

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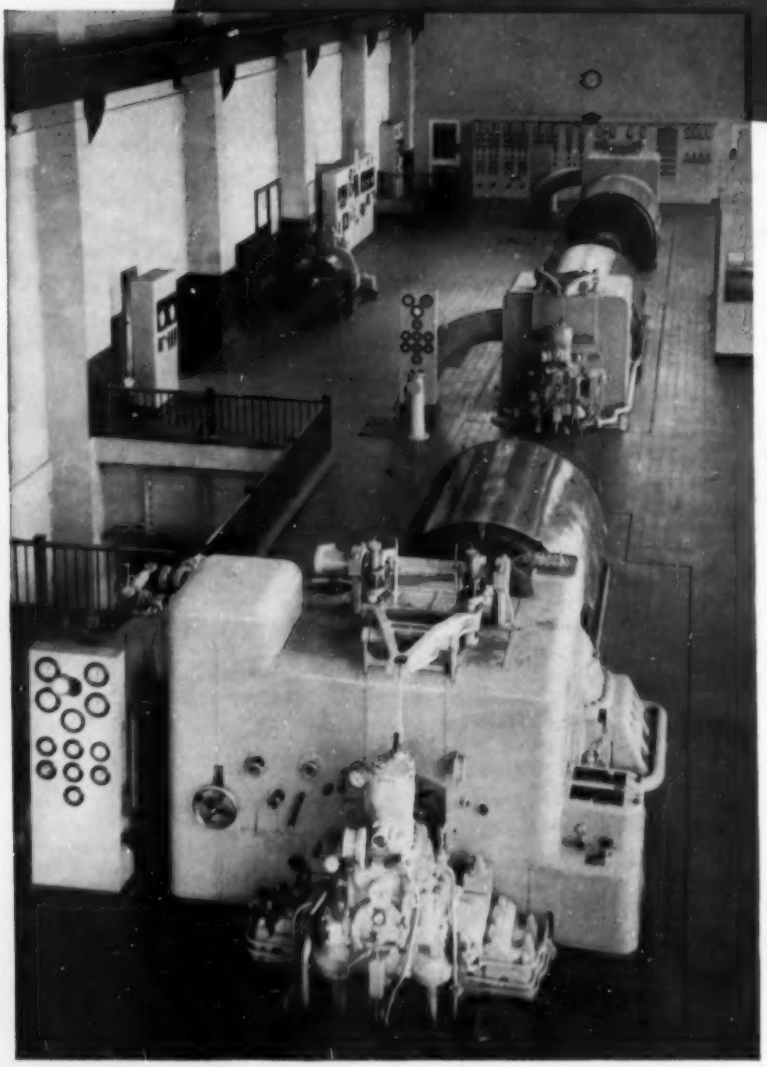

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